THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXXIV. No. 1897.] LONDON, SEPTEMBER 19, 1899. [51ST YEAR. PRICE 6d.

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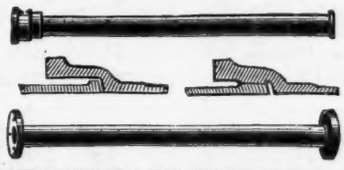

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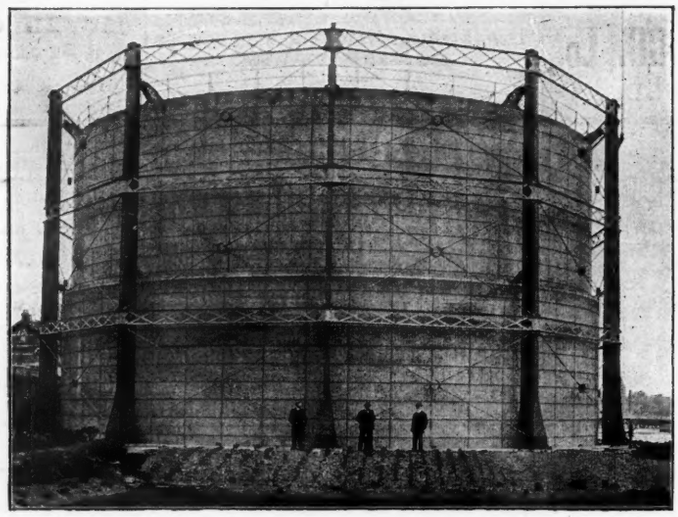

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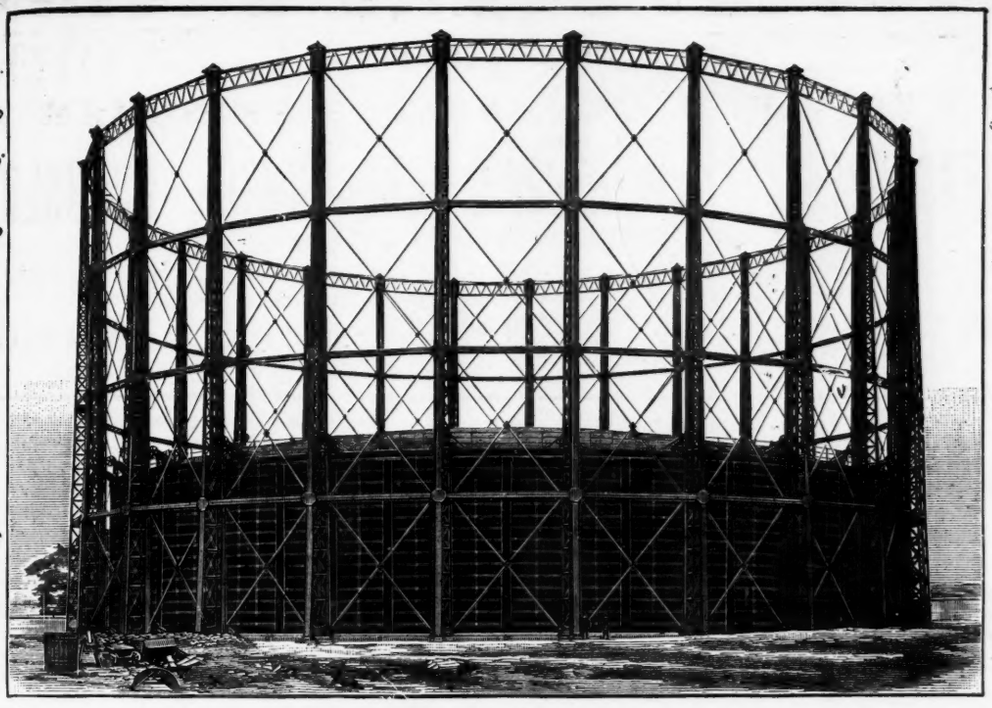

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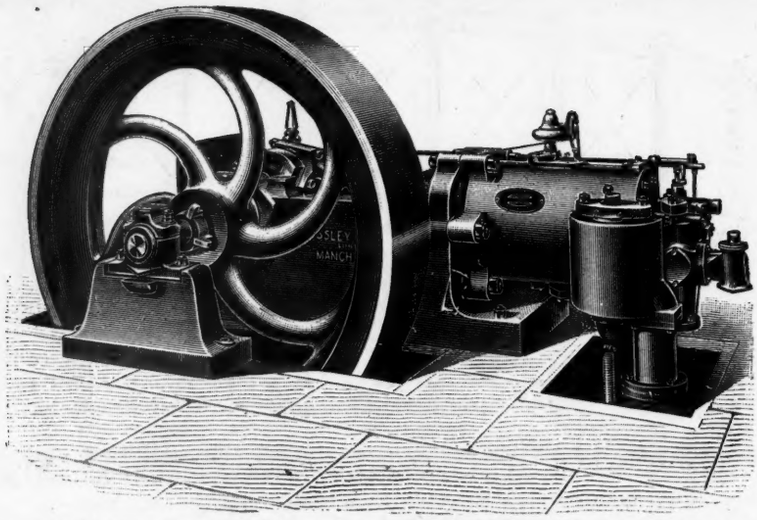

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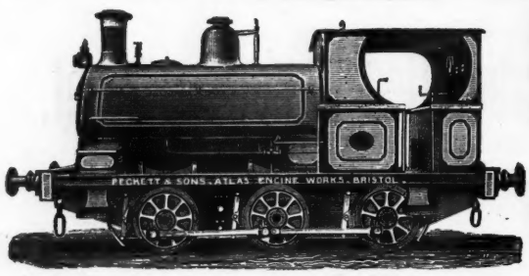

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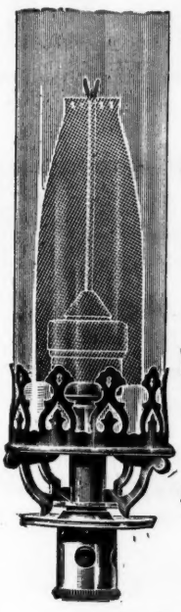

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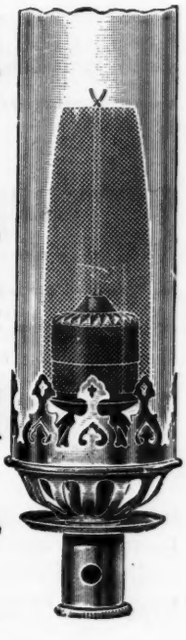

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MAXIM PATENT CARBURETTOR

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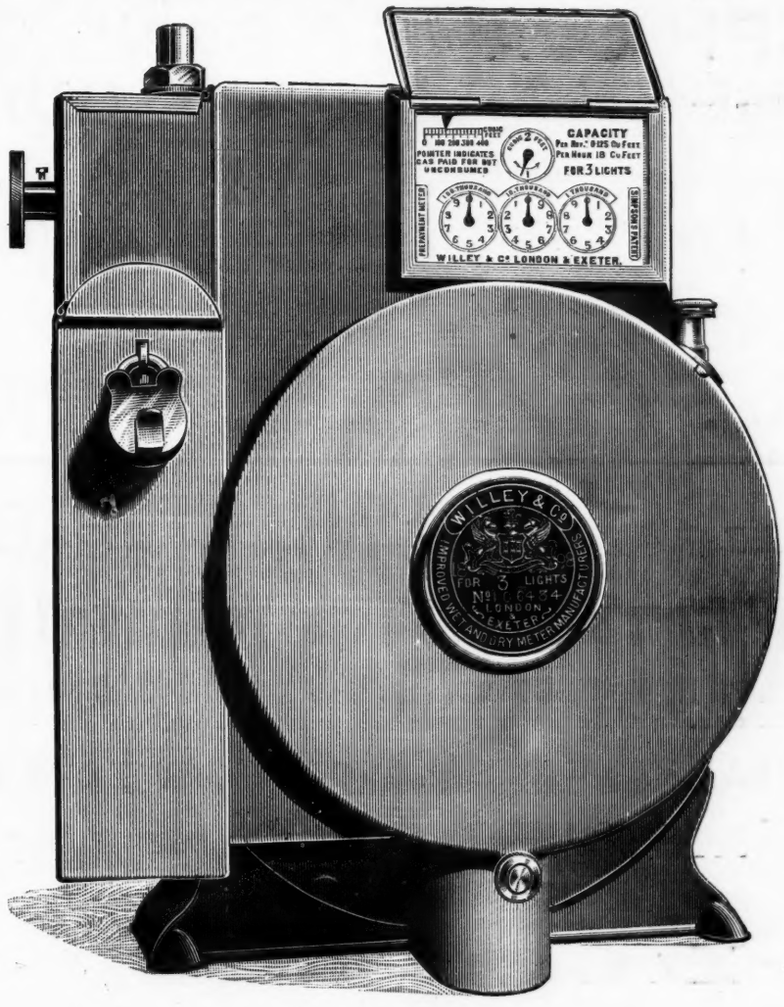

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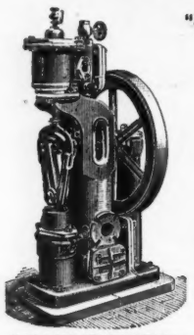

"Fig. 708. SINGLE RAM" STEAM-PUMP.

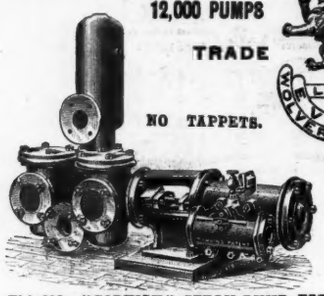

Fig. 596. "CORNISH" STEAM-PUMP FOR BOILER FEEDING, &c.

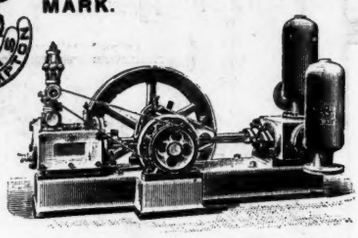

Fig. 685. "RELIABLE" STEAM-PUMP FOR TAR AND THICK FLUIDS.

Fig. 712. "DOUBLE-RAM" STEAM-PUMP.

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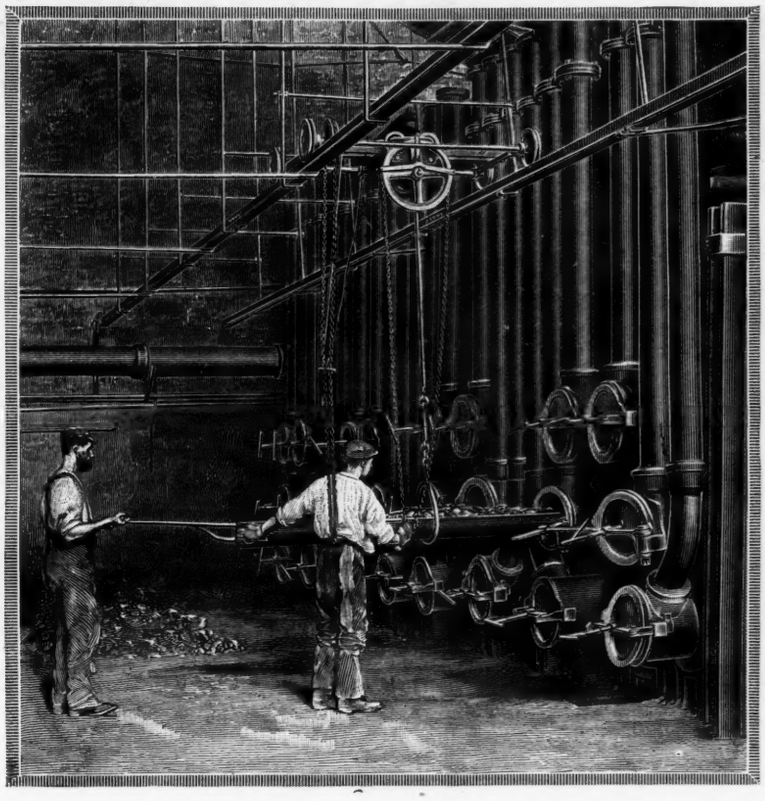

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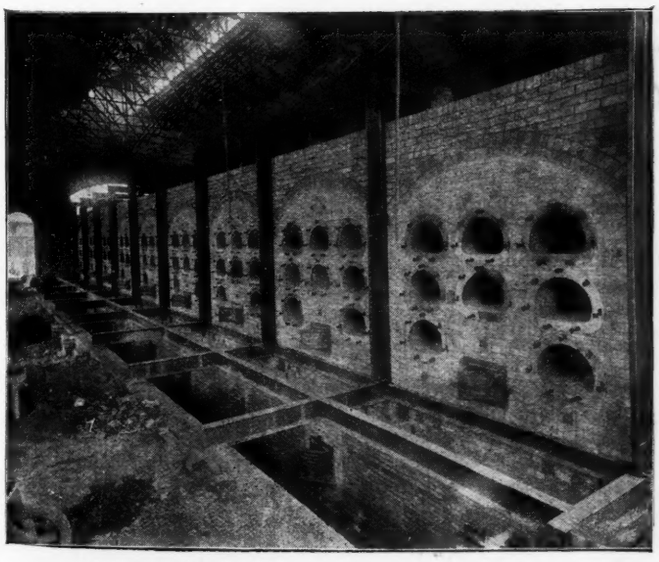

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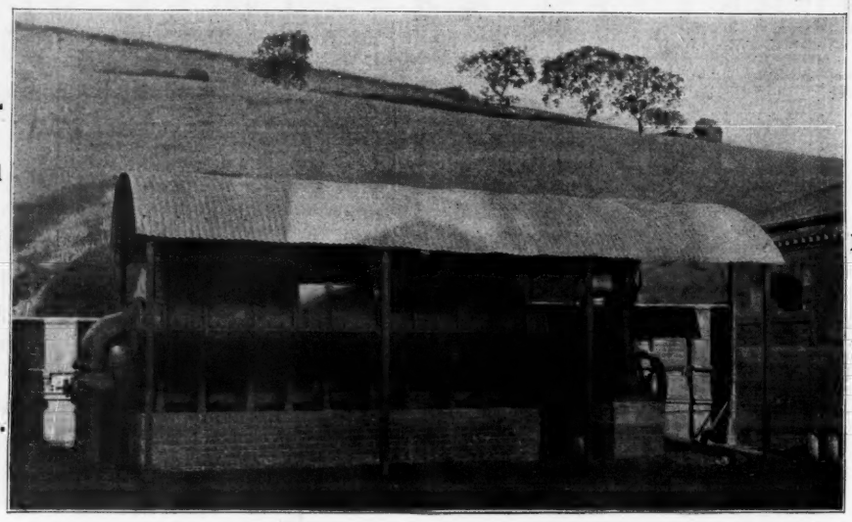

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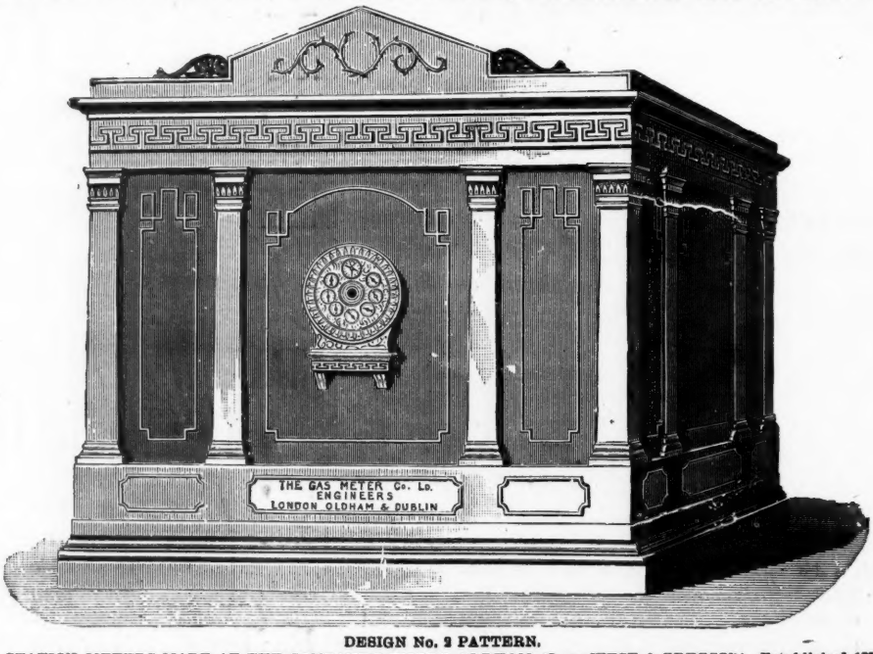

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Bath	1,000,000	Maidenhead	225,000
Newburgh, N.Y.	350,000	Epsom	225,000
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Coventry (Second Contract)	600,000	Falmouth	150,000
Bordentown, N.J.	125,000	Southampton	800,000
Winchester	200,000	Hartlepool	750,000
Shanghai	225,000	Utrecht	1,000,000
Stockport	500,000	Deventer	150,000
Norwich	1,000,000	Portsmouth	1,000,000
Holyoke, Mass.	600,000	Bournemouth	1,000,000
Lea Bridge	350,000	Aylesbury	150,000
Lea Bridge (Second Contract)	350,000	Hamburg	1,750,000
Stockton-on-Tees	500,000	Dublin	2,000,000
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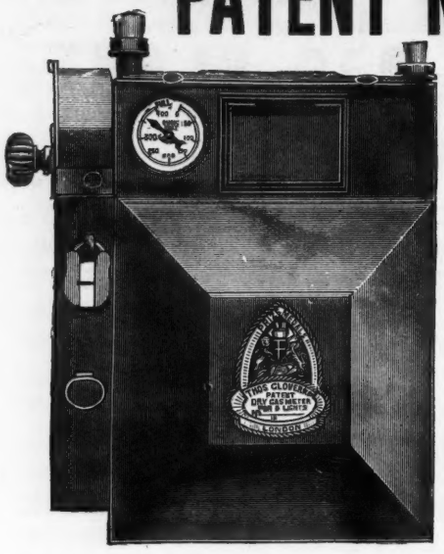

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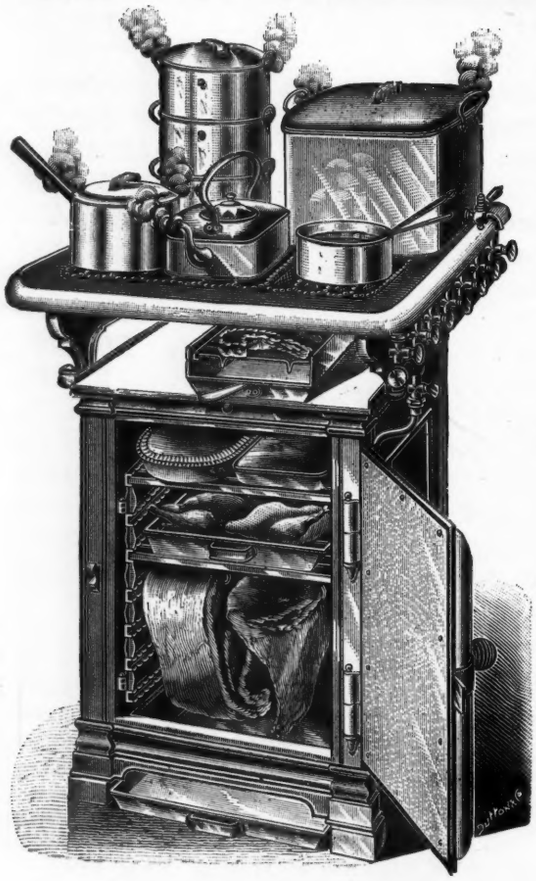

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No notice can be taken of anonymous communications. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

EDITORIAL NOTES.

The British Association—The Old Thought and the New.

THE meeting of the British Association at Dover last week was held in so comparatively small a town for the reason that the corresponding French Association was to meet at the same time in the almost neighbouring town of Boulogne. The opportunity for the fraternization of English and French "scientists"—hateful word, which one must use for lack of a better—was not to be missed. The President of the Association for the year is Sir Michael Foster, who, as a physiologist, dealt in his address with an order of subjects not very suitable for consideration in our columns. To the general reader, however, his discussion of the advance and bearings of science during the last century will be of great interest. It is, of course, impossible to exaggerate the extent and depth of the change wrought during the century in the course and subjects of human thought by what is called the scientific method. Those who think the thoughts of to-day can hardly realize the greatness of the gulf that separates them from the thinkers of a former dispensation, unless they accidentally come across a survivor of the older period. These still exist, in considerable numbers; but they have to be looked for, and when discovered carefully and sympathetically "drawn out," if their archaism is to be satisfactorily exhibited. The difference is simply this—the old thought was innocent of the orientation which the modern perception of the true nature of knowledge has imposed upon all speculation and reflection. The old thinkers were as the ancient navigators before the magnetic compass—they were all right so long as they kept to waters they knew; but they could not say what would happen if they took too bold a departure. Nobody was quite certain about any physical fact. People living in European countries had a general knowledge, for example, of the nature and properties of water; but when travellers in tropical climes assured them that the water of those regions was altogether different from the fluid they were acquainted with, they had no grounds for disbelieving the statement.

Even in the little world of the gas industry, men have ere now been willing to believe many things which the later breed of practitioners know to be impossible. Inventors used to persuade themselves and others that the yield of gas, or tar, or ammonia from coal might be doubled by passing some of the products through a new stage, or a secret process. Sometimes the men who thought they did this openly professed themselves incapable of giving the reason for their success. The present writer, some years ago, listened patiently to a man who proclaimed that by merely "cooking" air—passing it through a red-hot retort—he could so alter its properties as to render it susceptible of cheap conversion into illuminating gas. The only possible cure for this very old complaint is a sufficient dose of the modern scientific method. The man imbued with the latter-day spirit does not deny that there may be "more "things in heaven and earth than are dreamt of in his "philosophy;" but he bases his thinking about things in general on known data and the law of probability. "Science is measurement," says the modern thinker. He wants to know how things weigh or measure up.

To the Ancients there was nothing antecedently impossible in the sun being made to stand still for a day or two. What we have learnt to recognize as the imperative necessities of the natural order might or might not happen. A species of animal with a couple of backbones might await the daring traveller in some newly-found isle of the sea. An ingenious inventor might any moment hit upon a means of making stones tumble up instead of down. How strange to our circumscribed notions seems the confusion of thought through which our forefathers painfully stumbled, getting many a fall through their long persistence in taking so much upon trust! There is a good tale of a certain pond in the woods near an American town which was commonly reputed, and believed, to be bottomless. The most awful stories were current in the neighbourhood about the profundity of this water, into which whosoever ventured was never seen again. One day a man who had the misfortune of being armless, accidentally slipped into this dreadful pond, and in a fit of absence of mind actually walked across it. It was nowhere more than 3 feet deep, only it happened to be very much overshadowed, and consequently the water looked black. The story is an allegory. The old habit of thought would have

accepted its truth without a question, provided it was vouched for by respectable authority. The new method would send the bearer into the water with a rod.

The British Association has no surprises for the public this year; but it will carry the truth about many things a little farther, and into more minds than have yet received it. This is the chief justification of the gathering. Being so near the spot, the lights of geological science may clear up some of the mystery that hangs over the Kentish coal-fields. In the Political Science Section, the possibilities and limitations of municipal trading will be discussed once more. We give elsewhere the portions of the President's address which have evoked the foregoing reflections; and we may be able to pick up a sectional paper or two for reproduction in subsequent issues. But the technical interest of the meeting does not promise to be great.

The Autumn Meeting of the Institution of Gas Engineers.

THE Autumn Meeting of the Institution of Gas Engineers, in Berlin and Copenhagen (with Hamburg thrown in) has proved a splendid success—thanks first and last to the President, Mr. F. D. Marshall, the Engineer to the Danish Gas Company, and to the numerous generous hosts of the party, who made the trip all that could be desired as regards interest, instruction, and pure enjoyment. To the Directors of the Imperial Continental Gas Association, to their Consulting Engineer, Mr. Corbet Woodall, and to the several members of the staff of the Association in Berlin, the party were much indebted for the warmest of welcomes, as well as for the opportunity of seeing the German capital under the best and happiest auspices. The reception, direction, and entertainment of the visitors in and about Berlin were in the capable hands of a Local Committee of the German Gas and Water Engineers' Association, working under the superintendence of Herr W. von Oechelhaeuser, assisted by Dr. Bunte, and others. The heads of the Municipalities of Berlin and Charlottenburg vied with the German and Imperial Continental Engineers in kindness and painstaking desire to please the English strangers within their gates—thus presenting the spectacle (repeated in Denmark) of perfect accord between municipal and private trading organizations, which is not common everywhere.

In Denmark the dignitaries of Copenhagen were graciousness and hospitality personified; while of the Directors of the Danish Gas Company and their local representatives, headed by Mr. Cridland and Mr. Marshall, it is as unnecessary as it would be difficult to speak in adequate terms of acknowledgment and gratitude. The reception of the visitors was princely in style throughout; but it was not this lavishness which will be longest remembered by those who had the good fortune of being of the party. It was rather the thorough good-heartedness of everybody who had any share, however small, in the arrangements. The English travellers were made to feel that the welcome extended to them was sincere, and came from a genuine and intense desire to do them honour and give them pleasure for the sake of their nationality, for their profession, and for themselves. A good heart, ample resources, and excellent organization form a combination for doing work of this kind which can only have one result, especially when the subjects of all this solicitude are willing and anxious to reciprocate the kindly feelings manifested towards them. It was a grand experience throughout, for all concerned, and one that, in the nature of things, can hardly be paralleled in a lifetime.

In conclusion, we wish to repeat that if the secret of success of the whole affair might be given in a single word, that word would be the name of the President, Mr. Marshall. It was a great personal triumph for him. If ever a general organized a victory and made it the inevitable result of intention and complete previous arrangement, he did it in this case. He had his reward; and while the thanks of the whole Institution are due to him by right of conquest, those of the individuals who experienced his care will be given to him in pure love and gratitude for kindness that can never in the ordinary way be otherwise repaid.

Two District Association Meetings.

READERS of the report (published last week) of the proceedings at the meeting of the Manchester District Institution of Gas Engineers at Blackpool must have come to the conclusion that the members had a very good time, from a technical point of view. Ever kindly disposed towards organizations for the advancement of knowledge, the Corporation Gas Committee provided, by permitting the members to inspect the gas-works, not one of the least interesting items in the day's programme. In visiting works which have been under the care of a thoroughly go-ahead gas practitioner like Mr. John Chew for the long space of thirty years, one does so with an expectant curiosity, feeling sure that in such a place will be found points of novelty and method which will well repay serious attention. And, as Mr. William Carr in admirably fitting terms acknowledged, Mr. Chew's visitors were not disappointed. Outside their ordinary administrative work, the Gas Committee and their Engineer have had an exceptionally severe battle with the electric light, whose happy portion in the municipal home has been that of a favoured younger child. But, notwithstanding, during the progress of the contest the gas undertaking has added abundantly to its former prosperous career. When Mr. Chew first went to Blackpool, the output of gas was only 15 millions; now it is above 400 millions; and in the last six months the increase was about 20 millions. This is an amazing record; and Mr. Chew, like a veteran strong in his previous successes, to-day, in spite of the preference in the Council for things electrical, exclaims: "We "are not afraid of the electric light, and never will be." Well and boldly spoken!

At the business meeting, with the President (Mr. R. G. Shadbolt, of Grantham) occupying the chair, two papers were read; but only one—that presented by Mr. W. Whatmough—was discussed. In it he gave the results of the practical working of a self-loading governor at the Heywood Gas-Works. Automatic contrivances of this kind are still looked upon with a certain amount of misgiving by many managers; and published experience points to their utility being to a large extent dependent upon the conditions of the district. The apparatus described by Mr. Whatmough is simple in its action; and, after nearly six years' experience, he is thoroughly satisfied with its working. The diagrams, studied in conjunction with the accompanying explanations, besides being instructive, are convincing as to the usefulness of the instrument in the author's case. The discussion, so far as it went, on the main subject, decidedly sided with Mr. Whatmough; for the speakers who had had the modern type of pressure-changer under trial were in accord as to its advantages, while the two who expressed opposite views in the one case admitted that the governor experimented with was "not made with "the view of attaching a pressure-changer to it," and in the other that the automatic changer tried was "one of the "earliest types." Another interesting point mentioned by Mr. Whatmough was that, during the time the pressure-changer has been in use at Heywood, the leakage of gas has been reduced by 3·9 per cent.; but he does not claim that this is due entirely to the adoption of the changer. However, his remarks thereon, and the references to them in the discussion, are noteworthy. The second paper was by Mr. W. Chew; and it dealt with the application of gas traction to the Blackpool, Lytham, and St. Anne's tramway. The claims of the rival forms of motive power for mechanically operated tramcars have been so recently discussed in the "JOURNAL" that it is unnecessary to advert to them here. It may be observed, however, that the Blackpool gas-tramcar installation is by no means an insignificant one; and from the points of view of both cost and performance, Mr. Chew makes out a favourable case for it. Nearly every local authority in the country owning an electric lighting system and with a tramway within their borders are considering whether they cannot use the latter as a prop for the former; and therefore gas suppliers with an eye to the defence and expansion of their own interests, should not waste time before inquiring further into the latest experience at Blackpool and elsewhere.

The meeting of the Waverley Association of Gas Managers at Melrose last Thursday will be remembered as one at which the presidential address rose to heights which have not been attempted by most of Mr. M'Lusky's predecessors. It was withal an address peculiarly well adapted for the district in which it was delivered; and it was, further, a production of some literary merit. Both Mr. M'Lusky and the Association are to be congratulated upon it. The discussion which followed was of the usual work-a-day order. Two years ago the Association resolved to hold their next spring meeting in Edinburgh, as being

more easily reached than some towns in the district, and as, besides, giving the members an opportunity of seeing some of the public works in that city. The experiment was successful; and it was repeated last spring with like results. There are independent minds in the Association, however, to whom the idea of soliciting permission to visit works is repugnant; and, for the time being, the old practice is again to be followed of meeting within the district of the Association. This is a considerateness which speaks volumes for the spirit that rules in the organization. The Association have continued their Committee upon the standardizing of meter-unions. But the heart is knocked out of the movement; and it is admitted that all which was sought to be done officially can be as easily accomplished by each manager asking for couplings like his neighbour's, or by adopting and keeping to a uniform system for himself.

The Progress of the Sheffield Gas Company—The Naphthalene Trouble.

From a financial point of view, the story which Sir Frederick Mappin had to tell the shareholders of the Sheffield Gas Company last Tuesday must have been highly gratifying. A net profit of £43,000 was made in the six months ending in June; and after paying the dividends there was left a balance of £468, which brought up the amount carried forward to £18,452. But while full dividends had been secured for the proprietors, the consumers had not been neglected. The charge for gas was lowered by 2d. per 1000 cubic feet in April last year—bringing the prices down to 1s. 10d., 1s. 8d., and 1s. 6d.—which was equivalent to a gift of £10,295. Cheaper gas resulted, as usually happens, in greater consumption; and though one would naturally look for this, an increase to the extent of 130 million cubic feet in six months—equal to 11·76 per cent.—was, as Sir Frederick very justly said, remarkable. It stands out conspicuously in the records of the gas supply during the first half of the present year which we have lately been publishing; and it is satisfactory to find that it is not the effect of a "spurt," as it is being continued in the current six months. The use of gas for motive power is more appreciated in Sheffield, as shown by the number of engines fixed during the past half year; but the city compares unfavourably with Leicester in the adoption of gas-fires. This is a detail on which there is room for improvement; though, on the whole, this portion of Sir Frederick's story was not unsatisfactory. But when he turned from statistics to working, his tone was less cheery—and no wonder. The naphthalene trouble, unfortunately, is still present, notwithstanding all the efforts made to get rid of it. This erratic deposit is the bane of the existence of not a few gas managers, who will doubtless sympathize with their colleagues in Sheffield in their alternate elation and depression according as their hopes of finding a solution—in the strict sense of the word—of the difficulty were bright or dark. A reduction in the number of complaints to 17, out of 58,000 consumers, in March, naturally encouraged the belief that the enemy had been really conquered. It was but a delusion; for he has reappeared with renewed vigour. It must have been a relief to Sir Frederick Mappin to pass to the subject of incandescent gas lighting, of which he spoke very highly. He regards it as the "light of the future," and considers that its introduction has proved that gas, like the electric light, is still in its infancy. His final words were encouraging not only to the audience he was addressing, but to all who have a pecuniary interest in gas undertakings.

Coal-Kitcheners and Gas-Fires.

A lively discussion upon the subject of the common kitchen-range has been conducted in the columns of the "Daily News," in connection with some entertaining "Letters from London," by Mrs. Humphry. We do not know the lady as an authority on household matters; but she writes intelligently on her chosen topic. There cannot be too much public dissertation upon the advantages of gas-stoves as compared with coal ranges and fires. "Use gas-stoves," is Mrs. Humphry's counsel to the worried housewife. Her injurious remarks on house coal are refreshing, even during this hot weather. They are so thorough, so uncompromising. This is one of the charming characteristics of the "reformed," or "advanced" woman in politics and everything else. No half measures for her! The mere man is often content with a compromise, and is able to console himself with the reflection that the old grievance was not all bad, and the new remedy might not have turned out fully in accordance with expectation. Not so the new woman. Mrs. Humphry has done with house coal; and consequently it is all wrong. It is heavy, dirty, disappointing, will not burn, is not so good as it used to be, and as likely as not the merchant delivers short weight. Hence the recommendation of "gas-fires "in the kitchen, and in all the other rooms of the house." Where gas cannot be had, the advice is to try a good oil-stove, which is said to have the additional recommendation of being cheaper than coal. All this advice is to the good, and tends to help the public to grapple with the increasing cares of housekeeping in a democratic community. The ordinary "gas exhibition" business is being overdone, and tends to weary the public. All the more reason, therefore, to welcome intelligent disinterested advocacy of the use of gas for cooking and heating.

The Outlook in the South Wales Coal Trade.

The situation in South Wales continues threatening. On Saturday week, the first anniversary of the establishment of the Merthyr district of the South Wales Miners' Federation was celebrated, and Mr. William Abraham, M.P.—*toujours* "Mabon"!—made a speech advocating conciliation and peace. That most desirable end is to be attained in the simplest of ways; the one thing needful being that the masters should take the same view as the men. On that condition the men will keep the peace. A solution of labour difficulties that is quite charming in its simplicity! It is the lion lying down with the lamb—with the lamb inside. The men, according to the Federation officials, want to substitute Boards of Conciliation for the sliding-scale system. With this object, "it would," says Mr. Abraham, "be desirable to get their employers into the same frame "of mind as they were. So they were letting them know "in sufficient time . . . and, knowing that they [the "employers] had the time and the power to place matters "on a proper footing before the end of the present agree-"ment came about, the responsibility for whatever hap-"pened if justice were not granted would rest upon them. "A Conciliation Board was the proper means to settle dis-"putes, and the barbarous means of strikes and lock-outs "ought never to be renewed." We gather from this that if the employers do not grant "justice"—as defined by the men—the Federation will resort to the "barbarous "means" of a strike to obtain it. Mr. Abraham spoke further of the sliding-scale system as "leading to ever-"lasting fighting from month to month and year to year." We do not recollect that, before 1898, and the advent of the Miners' Federation, there was constant industrial strife in Wales, but rather that, under the sliding-scale, men and masters worked well together. The meeting, to demonstrate their conciliatory attitude, ended by resolving to give in notices, terminating their existing contracts, on the 1st of October, in order to bring pressure upon the non-Union miners in the Merthyr district to join the Federation.

On the following Wednesday, the 13th inst., the representatives of men and masters met in Cardiff, and the owners emphatically protested against this proposed termination of contracts; declaring that it would be distinctly illegal, and would be most strenuously resisted by them. The men, however, showed no inclination to amend their attitude, and expressed the opinion that the notices would have the effect, not of causing a cessation of work, but of inducing the non-Unionists to join their ranks, and that thereby the stoppages of work that occasionally arise from the presence of non-Unionists in the collieries would in future be avoided. At the same meeting the question as to which collieries should, and which should not, be brought into account at the ensuing audits, to which reference was made in our article a fortnight ago, was discussed; and, although the final decision was deferred, the men succeeded in arranging that the next audit should be conducted on the old lines—the newly-associated collieries being excluded, and the Bute-Lewis pits brought in. The conference adjourned until to-morrow. At a meeting of the Executive Council of the Miners' Federation, held the same day, ominous reference was made to the "register-"book" which, it will be remembered, the Coalowners' Association are seeking to introduce. A District Secretary having written to ask that a conference might be called upon the subject, a reply was ordered to be sent

directing attention to a resolution previously adopted by the Council, to take immediate action—without calling a conference—at any colliery where the signing of this book might be enforced. This resolution, in combination with the register-book, makes a fine "explosive mixture."

The following day, Cardiff was the scene of another conference—this time between the delegates of the enginemen, stokers, and outside fitters of the Monmouthshire, Merthyr, and Dowlais Colliery districts and their employers, to consider the demands of the men, and to endeavour to bring about a settlement. On the 14th of August these men, who are seeking to have their wage-standards brought up to those ruling in the Rhondda Valley, handed in a schedule of the increased rates for which they are asking, with a request for a conference thereon with their employers. That conference was, however, not granted until the men, on the 1st inst., handed in notices terminating their contracts at the end of the month. This meeting, as we have said, took place last Thursday; but it failed to bring about any agreement. The masters refused to discuss the rates of wages unless the men would withdraw their notices, or suspend them for a month; but, in spite of an intimation from the Chairman that, upon those notices being withdrawn or suspended, the owners were prepared to submit a schedule of amended rates, the men's representatives declined to take the responsibility of such a step, and the meeting came to an abrupt conclusion. It was, however, understood that if, upon consulting the men they represent, the delegates found themselves able to suspend the notices, and to allow adequate time for discussion, the owners would be willing to meet them again. The men giving notice only number some 800; but their withdrawal from the collieries would throw idle some 20,000 miners.

This bald record of the meetings and conferences of the past ten days will serve to indicate the present "electric" state of the atmosphere in the coalfields of the Principality. Whether the clouds will break or disperse we cannot venture to prophesy.

Transvaal Troubles Involve Gas Engineers.

It is our desire to keep our editorial columns as closely in touch as possible with the passing events of the time. While never forgetting that our chief duty is to cater for the intellectual needs of a public of specialists, whose particular interest is in a class of topics that lies outside the purview of the ordinary Newspaper Press, we endeavour to cultivate rather than ignore anything that binds our and their speciality to the greater common life of which it forms a part. In short, we bear in mind the truth that our regular readers are citizens as well as followers of the gas industry. But for all this, we should hardly have expected to be called upon, without quitting our proper journalistic domain, to discuss the condition of affairs in the Transvaal. Yet this strange obligation has been created by the intelligence published in a Huddersfield newspaper, that among the high-handed and corrupt dealings with the people who have gone to the Transvaal to trade which have caused the actual Transvaal crisis, the treatment meted out to a British firm of gas engineers is to be included. The story illustrates very strikingly the spirit and conduct of the Boer administration of the country. Messrs. Read Holliday and Co., the well-known patentees and manufacturers of acetylene gas apparatus, acquired protection for their speciality under the Transvaal Patent Law. The only Transvaal patents covering the trade in carbide of calcium or acetylene gas were in the name of the firm. Notwithstanding this circumstance, the Transvaal Government granted to another firm a concession of the sole right to make and sell calcium carbide in the country. Upon hearing of this, the patentees served notices of their position in regard to the matter upon the Government and the concessionaries. The latter did not reply; but the State Secretary answered that if the patentees felt themselves aggrieved at what had been done they could institute an action against the concessionaries "in a competent Court." The humour of this reply lies in the fact that the real defendants in any such action would be the Transvaal Government, who granted the concession for a calcium carbide monopoly for thirty years certain, renewable for a further term of thirty years, for the published consideration of receiving 10 per cent. of the profits after the factory has been producing for a period of three years. It is stated that the concessionaries offered to sell their concession to the Holliday Company for £15,000 in cash. It is unnecessary to speculate upon the intrinsic value of a Transvaal patent for the manufacture of calcium carbide or acetylene, in order to find grounds for judging that the action of the Transvaal Government in granting a monopoly of the trade to another party is outrageous. Dealing in monopolies is one of the practices of the Boer Government that presses hardest upon the industry and trade of the country. The existence of a patent system in a country so administered is an absurdity. The Government is above the law, so that the usual remedy for grievances available in civilized countries is not open to the victims of the Administration. This being the state of affairs in the Transvaal in only one particular respect, it is not to be wondered at that the paramount Power are determined to see that the Boer Government act for the future more in accordance with the elementary principles of common justice and the laws of civilized communities.

The Attack upon the Poor Law.

An impressive article recently published in "The Times" declares that "a determined attack is to be made upon the "present Poor Law in all its branches of administration." This, if correct, is not very pleasant hearing for those who pay the heaviest share of local rates in their particular districts, among whom the proprietors of gas undertakings must be included. It is true that the pressure upon the rates is very severe, and is continually increasing; so that it becomes an urgent question as to what can be done to mend matters in this regard. The quinquennial revaluation of the Metropolis is to be made next year; and the London County Council have been looking into the subject, with the probable result that there will be a greater outcry from the victims of assessment than ever. Rates are being drawn upon for fresh objects every year, while there is no corresponding extension of the basis of contribution to them. The heaviest drain upon the rates comes from Poor Law administration; and those who can argue from the signs of the times are seriously disturbed at the prospects opened by such reports as that of Mr. Chaplin's Old-Age Committee, of an unlimited growth of expenditure in this direction. "The report of the Cottage Homes Bill Com-"mittee breathes an increase of rates in every line of it. "And upon the top of it comes the Pelion of the Old-Age "Pension Committee." There is much wisdom, therefore, in pausing to consider what is already done in this country in the name of Poor Law administration, before any new-fangled schemes for further expenditure are looked at. The writer in "The Times" pertinently asks where and what is the justification for all this sudden and ardent expansion of philanthropy. He contends that the Poor Law is very elastic as it is, and on the whole works exceedingly well. He goes strongly for those who find fault with it; declaring that "the success of the Poor Law in meeting destitution, in unpauperizing the country, and in "inculcating habits of independence and thrift, is absolutely unimpeachable." Who talks of the necessity of a new system of old-age pensions? What is the out-relief which is now extended by the guardians but the same thing under an old-fashioned name? Possibly this is true; but Mr. Chaplin's Committee quote the Senior Inspector to the Local Government Board as testifying that "the "way in which relief is administered now in too many "cases is distinctly cruel to the poor." This is a hard saying for those to get over who maintain the sufficiency of the existing system.

It seems tolerably clear that the rates throughout the country are going to be much heavier than they are, if all the sanitary and humanitarian legislation that there is in prospect is carried out. This is a serious consideration for the owners of rateable property in general, and of industrial rateable property especially. It seems only fair that the basis of assessment should be widened, so as to include that enormous bulk of personal property which at present escapes the rate collector. It is no longer the great man living in his big house, and spending an income which he does nothing to earn, who is the mainstay of a community. The small town of old began by clustering round the baron's castle or the bishop's palace for protection, and, incidentally, for support. The modern town is the consequence of successful industrial enterprise. Naturally, it is difficult to make a Tudor principle answer Victorian requirements. We believe that any consider-

able extension of the relief of the poor will be charged in the first place upon industrial and commercial profits, rather than upon heritable property. The Workmen's Compensation Act began it; and no man can see to the end of that new thoroughfare. Meanwhile, the rate collector is looming larger than ever in the near prospect; and there is no escaping him for those whose local standing is commensurate with their means.

Old-Age Pensions and Protection: A Protest.

It is always much more easy to suggest reforms involving the expenditure of large sums of public money than to devise equitable means for raising the funds required. The advocates of any such reforms generally prefer to consider the finding of the wherewithal a matter for the Chancellor of the Exchequer. They are to point the way; he the means—a pleasant arrangement, whereby the reformers are to have the credit of the improvement, and the Minister of Finance the discredit of increased taxation. In this respect the propounders of schemes for pensioning the aged deserving poor seldom differ from those who clamour for an increased Navy or for "free" anything and everything. They draw up measures whereby all or some persons who reach such and such an age are to receive a certain weekly allowance. They then generally, though not always, estimate the cost of such provision, and dismiss the question as to how the outlay is to be met by saying that it is to be a "charge on the Budget," and that the incidence of taxation is a matter for experts to determine. This was practically the line adopted by Mr. Chaplin's Committee. Half the cost of their scheme they suggest should fall on the rates; the remainder on the taxes—in what shape or form they leave for the consideration of the experts. Since the report was presented, however, Mr. Chaplin, in the course of an address delivered last month to Lord Londonderry's tenants, has thrown out a suggestion as to how the cost of his proposals may be met, which, coming from a Cabinet Minister (and not, as yet, repudiated by his colleagues) calls for notice, and for protest from all concerned in the commercial prosperity of the country. We do not, we need scarcely say, make our protest in any partisan spirit, but as the journalistic mouthpiece of one of the foremost industries in the country, interested vitally in the cheapness of labour and of manufactured goods.

Mr. Chaplin's suggestion is that "a nice little nucleus "for any modest scheme of old-age pensions proposed" might be provided by the re-imposition of the shilling per quarter duty on imported corn, estimated to produce two millions or more per annum. Mr. Chaplin has since protested that it is quite untrue to say that he was "proposing a return to the Corn Laws—to the old "protective system and dear bread;" but most assuredly this was the impression his speech created. He appears to think that the two millions a year might be raised without anybody paying it; for he says that a shilling corn-tax would not affect the price of bread. But it is obvious that neither the importer can afford to take 1s. a quarter less profit—it is too cutting a trade—nor the baker to pay more for his wheat without charging more for his bread; so, apparently, the two millions would fall like manna from heaven upon the Treasury. Mr. Chaplin contends that bread only alters in price in consequence of a change of 4s. or 5s. in the price per quarter of corn. Then, if five different causes each raises the price of corn 1s., is the fifth only to bear the responsibility for the consequent rise in the price of bread, and has the first no share therein? Again, if some cause had sent corn up 3s. or 4s., and the price of bread had not altered, would not the imposition of a duty of 1s. turn the scale?

We need not further demonstrate the obvious fact that any rise in the price of corn contributes to that extent to send up, or delay the fall of, the price of bread. What guarantee is there, however (and this is the most serious aspect of the question) that, if once a duty were re-imposed on corn, it would stop at 1s.? If twelve pence, why not twelve shillings? If on corn, why not on cattle, or any other imported goods? We need scarcely point out—although, since the Free Trade *versus* Protection controversy has largely faded from, or never impressed, the memory of the present age, it may be necessary to recall—the fact that duties on imported goods raise correspondingly the price of home-produced goods of the same description from which, of course, no revenue is derived to the customs; and that to increase the price of food-stuffs is to increase wages, and therefore the cost of the production of all manufactured articles, entailing a still further rise in wages. Free Trade has been, and is, the "bed-rock" foundation of our commercial and industrial prosperity; and against any tampering with that foundation we most emphatically protest. A sound scheme of old-age pensions may be a desirable consummation of all the Commissions, Committees, and Inquiries; but the "thin end" of Protection is far too high a price to pay for it.

The Corporation of London and the Audit of the City Accounts.

The Officers and Clerks Committee of the City Corporation have, we learn, presented an important report on the question of a more efficient audit of all accounts presented to the Corporation Committees. The Committee recommend that the present Accountant Clerk should in future be styled the Accountant Auditor; that he should possess the fullest powers of an auditor; that his department should be separate from, and independent of, any existing department, and subject only to the control of the Court of Common Council and the Officers and Clerks Committee; and that he should be empowered to order account books to be entered up at any time, and to examine the cash balances, so as to ascertain that all cash is properly accounted for. The Committee further recommend that the proposed Accountant Auditor should inspect all such books, accounts, and other documents as he may consider necessary; that he should examine the City Surveyor's certificates, bills, and accounts before payment; that no warrant should be drawn or payment made unless the account be signed by the Auditor; and that he should check all contracts and orders authorizing expenditure, and report whether the expenditure is in excess of the amount voted. It is a matter of considerable satisfaction to find the City authorities setting so good an example to the business world in general. The necessity of auditors occasionally comparing authorized with actual expenditure has been especially pointed out in these columns. Will not the Directors of some of the largest of the gas undertakings consider the advisability of instituting an independent—and well-paid—audit department? Auditors so appointed should be instructed to report personally to their Directors from time to time.

Remarkable Case under the Workmen's Compensation Act.

A noteworthy example of the practical operation of dominant Trade Unionism is supplied by a case under the Workmen's Compensation Act, heard recently at the Rotherham County Court. The plaintiff was a pit lad named Isaac Bissell; and he sued his late employers, the Cortonwood Colliery Company, Limited, for compensation at the rate of 5s. 7d. per week. The injury in question was a crushed wrist, received in the course of the ordinary employment. Compensation was paid for three weeks, after which the Manager told the lad he would have to begin work again in a different capacity—that of a lamp carrier in the mine, which he was quite capable of fulfilling. The Trade Union interfered, however, and ordered the lad to do no work until he was able to go back to his old job, which might be in six months, or never. The point raised, it will be seen, is precisely that for which the coalowners contended while the Bill was passing through Parliament—the power of employers to take account of the ability of a claimant for compensation to do some work, although not to the full measure of his former capacity. In this case, the employers' doctor certified that the lad was capable of carrying lamps, at 1s. 8½d. a day; his previous rate of pay being 2s. 3d. per day. The lad was offered this partial employment, and the Union advised him not to take it. His Honour Judge Waddy, Q.C., in giving judgment for the defendants, animadverted upon the circumstance of his having been "led away by the wrong-headed and obstinate determina-"tion of those people who were behind him, and who actu-"ally gave him the unscrupulous advice that he should "do nothing, although he was able to work." There was no ground for the action. Yet this suit will go to swell the number of lawsuits referable to the Act, and thus support the cry that it provokes a lot of litigation! It is of no use to lecture a Trade Union. The only way to touch a Union is to penalize it, or, if this cannot be done, to neutralize its action. The fond delusion that a man who is accidentally injured in the course of his employment should keep from doing anything at all until he is able

to return to his old job, is just the plausible sort of fancy to take a Trade Union executive. The consideration that it is "against the law of the land, the law of common "sense, and the law of common justice," as Judge Waddy put it, is not likely to weigh for a moment with people infatuated with Trade Unionism. The fact remains, however, that by the law of Nature to which all must bow, a man who loses a leg must thereafter get about as best he can without it. That is the principle recognized by the Act; and the sooner Trade Unionists recognize it, the better for them. It is unfair to the framers of the Act, and still more to employers, to cite these cases of wrong-headed resistance to the law as instances of hardship to those whom the Act was intended to benefit.

WATER AND SANITARY AFFAIRS.

ALTHOUGH the letters which have lately passed between the London County Council and the Local Government Board, and which are given elsewhere, have lost some of their interest from the circumstance that they refer to meteorological and other conditions which happily no longer exist, they nevertheless form a not uninteresting chapter in the history of the Metropolitan Water Supply. It may be remembered that soon after the recent drought set in the Water Committee of the Council manifested a great deal of concern as to the low condition of the Thames and Lea, and the effect thereof on the supply of water. They presented a rather alarming report on the subject; and the cue was quickly taken by a section of the Press who were anxiously waiting for a suitable opportunity for once more raising the cry of "Water Famine at the East-end." Furthermore, they decided to stir up the Local Government Board, and remind them that they had become responsible, under recent legislation, for seeing that the requirements of the inhabitants of London in respect of water were satisfied. They accordingly instructed the Secretary of the Council (Mr. C. J. Stewart) to send the letter which appears in another column. The attention of the Board was called to the state of the two rivers; and an opinion was expressed, based upon particulars furnished by the Engineer (Sir A. R. Binnie) that, unless the rainfall in the immediate future very much exceeded the average, the Thames could not recover even its normal summer flow, while it was not unlikely that before the end of September it would be less than that of last year; in which case the draught that would be necessary in order to keep London fully supplied would absorb the greater portion of the river. In fact, judging from the Committee's report and the statements to which its publication gave rise, the Thames in its upper reaches would soon be reduced to a trickling stream, and in its lower ones converted into a pestilential ditch. The Committee were pleased to think that, so far as East London was concerned, the Royal Commission were satisfied that the East London Water Company would be able, with the assistance of other Companies, to maintain until October the full supply required by the consumers. At the same time they suggested that, in view of the condition of the two rivers furnishing the bulk of the water supply to London being such as to cause considerable anxiety in many quarters, some assurance from the responsible officers of the Government that all proper steps had been taken to enable the Companies to assist each other in case of necessity, would be valuable. While asking for this assurance, the Committee respectfully requested the Board to favour them with their views as to the prospects of the water supply being adequate during the ensuing four months (presumably till the end of October), and how far the communications between the works of the several Companies were capable of meeting the needs of the present year.

Mr. Stewart asked for a reply to his letter in three days; but six weeks elapsed before it was received. It was signed by one of the Assistant-Secretaries of the Board (Mr. J. Lithiby), and contained, as will be seen on reference to it, a very neatly administered snub to the authorities in Spring Gardens. With regard to the state of the Thames, Mr. Lithiby forwarded a memorandum by the Engineer to the Conservators (Mr. C. J. More), in which it was acknowledged that the long-continued drought had considerably reduced the flow of the river; but at the same time it was stated that there was no cause for anxiety as to its adequacy to meet the requirements of the Water Companies. With reference to the connection of the Companies' systems of distribution, the Council are reminded that a scheme of intercommunication on a larger scale than that which has been carried out could not have been completed during the present year, and that, moreover, the Government were urged, on behalf of the Council, to limit their requirements to the provisions necessary to secure the East-end of London against the recurrence of a water famine. As to the draught upon the river, in its then low condition, being likely to "absorb the greater portion of the water," and thus jeopardize the supply, the Board point out that this is a considerable departure from the opinion expressed by Mr. Dickinson, the Chairman of the Water Committee, when the Council were opposing the Staines Reservoirs Bill in 1896, for he stated that they would not be objecting to the Bill if they were not sure that the consumers were "safe for seven years." This is a very proper reminder. The Board go on to say that, from the experience with the Thames and Lea during this and last year, it seems to be clear that "the future security of the water supply of the "Metropolis and the adjoining districts depends upon the "construction of reservoirs for the storage of surplus water." As to the prospects of the supply being sufficient for the ensuing four months, the Board reply that they are not more competent than the Council or anyone else to form an opinion; and they naturally decline to be prophetic. But they are strongly of opinion that the question of additional storage in the valleys of the Thames and Lea "is becoming of more and more importance every day "for the security of the water supply of the Metropolis "in the future." This is one of the most important pronouncements which have ever emanated from the Board. They point out that the policy of the Council has been to oppose applications from the Water Companies for powers to carry out these admittedly necessary works, and they remind the Water Committee that only last session the Council were successful in effecting the defeat of a Bill which would have sanctioned the construction of reservoirs having a capacity of 5000 million gallons. We regretted at the time the rejection of the Bill referred to—that of the East London Water Company—by the Committee of the House of Lords, after it had successfully passed the Commons; and we think the Company acted wisely in placing the facts before the Local Government Board and the Press, and in putting the responsibility on the right shoulders. To what extent, if any, the intervention of the Board during the passage of the Bill through Parliament may have militated against it, it is useless now to inquire. It is at least gratifying to find them acknowledging in their letter that they have always regretted the opposition which proposals for the purpose in question have encountered, because, in their opinion, "the supply of water necessary "for the Metropolis must be obtained from these sources "during the next fourteen or fifteen years in any case;" and they direct the Council's attention to the fact that "failure to obtain the necessary authority from Parliament "might result in scarcity of water affecting the whole of "the population of London and the suburbs within the "districts of the Water Companies." This is plain speaking on which the Council will probably have something to say when the members re-assemble after the holidays. But we think they will have some difficulty in disproving the charge brought against them.

North of England Gas Managers' Association.—The 45th half-yearly meeting of this Association will be held at Newcastle-on-Tyne on the 7th prox.—Mr. W. Doig Gibb in the chair. After an inspection of the Redheugh works of the Newcastle and Gateshead Gas Company, of which Mr. Gibb is the Engineer, the business meeting will be held in the Board-room. The proceedings will consist of the President's Inaugural Address, and a paper on "Governors" by Mr. E. H. Millard, of Durham. The Chairman and Directors of the Company have invited the members to dinner at the County Hotel in the evening.

Gas from Sewage Sludge.—At the annual congress of the Sanitary Association of Scotland recently held in Hawick, Mr. T. Melvin, Manager of the Dalmarnock Sewage-Works of the Corporation of Glasgow, read a paper on "Recent Developments in the Disposal of Sewage Sludge." The writer said that, after two years' endeavour to get their dried and pressed sludge taken up by farmers, they had now succeeded in their efforts, by crushing the material, and selling it as a fertilizer. In his paper, Mr. Melvin stated that between 6000 and 7000 cubic feet of gas could be extracted from each ton of sludge, but that the illuminating power was only between 7 and 8 candles.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 715.)

BUSINESS on the Stock Exchange last week was very quiet; but a remarkable feature about it was the persistently hopeful view which was taken in regard to the Transvaal difficulty almost up to the close. An easier feeling was apparent from the start, and became more confirmed day by day until Thursday, when, with easy money, a smooth settlement, and general cheerfulness, something resembling activity, coupled with firmness, set in. The next day, however, a sharp check was administered by wire from South Africa; and the week closed more cloudily. Still, on the whole, prices did not lose all their gains; and the advances outweigh the reductions, except in the American market. Had the reply of the Transvaal Government, however, been known before the close of business, it might have been otherwise. In the Money Market, there was an abundant supply; and the small requirements of the Stock Exchange could make no impression on it. Discount rates ruled steady. Business in the Gas Market continued extremely quiet, and was entirely devoid of any remarkable features. Changes in value were very few in number, and slight in degree; but they were all for the better, and the general tendency all round was to firmness. In Gaslight issues, there was a little done daily in the ordinary, which seemed inclined to go a shade higher, but could not quite attain a rise. In the secured issues, there was more comparative activity, coupled with good prices, and a gain of a point in the maximum. South Metropolitan was rather more brisk at the old figures; but it did not promise to improve upon them. Commercials made no sign. The Suburban and Provincial group presented no feature, except that Brentford was very firm, and Brightons came out rather better *ex div.* The Continental Companies shared in the prevailing inactivity, and underwent no change. The rest in distant parts of the earth were equally featureless, beyond an improvement in Cape Town bonds. Business in the Water Companies was as limited as usual, and no changes took place.

The daily operations were not sufficiently important or interesting to call for detailed notice. On Monday, Tuesday, and Wednesday, there was small business at a uniform level; and quotations did not move. On Thursday, Cape Town bonds improved 1. On Friday, Gaslight maximum advanced 1; and a few issues were quoted *ex div.*, as shown in the List. Saturday was almost stagnant.

ELECTRIC LIGHTING MEMORANDA.

The Legality of the Wright System of Charging for Electricity—The Case of Some Chelsea Consumers—Adoption of the System in Glasgow.

LAST week we discussed the Wright, or maximum demand, system of charging for electricity supplies, and expressed the opinion that it could not be applied except by agreement. Our contention was based upon Section 20 of the Electric Lighting Act, 1882, which runs as follows: "The undertakers shall not, in making any agreements for a supply of electricity, show any undue preference to any local authority, company, or person; but, save as aforesaid, they may make such charges for the supply of electricity as may be agreed upon, not exceeding the limits of price imposed by or in pursuance of the Licence, Order, or Special Act authorizing them to supply electricity." The saving in this clause refers to the preceding one, which enacts that all persons within the area of supply shall "be entitled to a supply on the same terms on which any other company or person in such part of the area is entitled under similar circumstances to a corresponding supply." Everything here turns upon the question of equality of circumstances. An equality clause is a creation of the statute; the obligation to treat all customers alike being absent from all trading to which it is not specifically applied. In the case in point, it is arguable that the Wright system is legalized by the requirement of Section 19 that consumers "under similar circumstances" should be treated equally, because it is precisely the similar circumstances of different consumers that would procure them the same treatment by the undertakers. On the other hand, those consumers who would be mulcted in the highest rates might urge that this amounts to a prejudicial treatment of them as compared with other consumers.

In the illustrations published of the possible working of the maximum demand system by the new rules of the Chelsea Company, there are two examples of installations of 400 lamps. In one, the average number of lamps used per day is 60, for four hours, while sometimes all the lamps are used. The average price per unit in this case would be 10½d. In the other example, of the 400 lamps 150 are used on the average for five hours a day, while sometimes the whole are in use. The average charge per unit works out in this case to 5·4d. Now it is quite certain that, while this second example might pass as legal under Section 19, because any other consumer under similar circumstances would be charged the same price, yet the consumer in the first example would have the right to protest because the system brings the price charged to him above the statutory maximum of the Company, which is 8d. per unit. Hence, wherever the maximum demand system is adopted, care must be taken that it always varies the rate in favour of the consumer—never against him. It should always be optional for the consumer to be charged on the fixed price system. Otherwise it is doubtful if the undertakers could recover their charges in a Court of Law. This point is worth making, because electric lighting undertakings are not too respectful of the Act of 1882 in other matters. For instance, the Act says that they shall not restrict the consumer in his choice of lamp or burner; yet many of them have put up the voltage to 200 and upwards, which materially limits the choice of lamps.

A most important victory of the maximum demand system is its permissive adoption by the Corporation of Glasgow. The Corporation have decided to try the experiment on the basis of 6d. and 1½d. per unit. It is framed in this way: For any quantity of current taken up to, but not exceeding, the maximum demand for 365 hours in the twelve months (being an average of one hour per day), the price will be 6d. per unit. For all excess, 1½d. per unit. The alternative is a fixed charge of 4s. per annum for every 8-candle, or 32-watt, lamp (or the equivalent), with an additional charge of 1½d. for every unit actually taken and recorded by the meter. Consumers taking current for the equivalent of five hours or more per day for every day in the year are charged throughout at the rate of 1½d. per unit. These prices, it is hardly necessary to observe, are extremely low all round. The Corporation can very well afford to supply electricity all day or night long for 1½d. per unit. They would like to do it in preference to doing business on any other terms; but the conditions do not permit of it. If every consumer regularly used all the lamps fixed upon his premises, it would be easy to proportion the plant to the calls upon it, and so use capital and everything else to the best effect. It is, however, the consumer of irregular habits who costs the undertaking most. It is as much as the Corporation can do to supply at 6d. per unit the consumer who does not use his lamps an average of an hour a day throughout the year. Still, this is the maximum price; and the Glasgow consumer so circumstanced pays it, or thereabouts, no matter by what system he elects to be charged. If a Glasgow resident has 25 lamps of 8-candle power on his premises, it follows that at the normal duty of such lamps he would take about 273 units a year if he used them all for an average of an hour a day. This quantity, or anything less, would be charged for at 6d. per unit = £6 16s. 6d. For everything beyond, the charge would be at the rate of 1½d. per unit. Supposing the lamps in this case to be used an average of two-and-a-half hours per day, which is not far from the mark, they would take a total of 683 units; and the extra quantity would bring the bill up to £9 7s. 9d. Under the fixed charge plan, in the first case the consumer would pay 4s. per lamp as the "stand-by" charge, amounting to £5. His 273 units, at 1½d., would run to £1 14s. 2d.; making a total of £6 14s. 2d., as against £6 16s. 6d., under the alternative system. In the second case (consuming 683 units), the fixed charge system would work out to £9 5s. 5d., as against £9 7s. 9d. Thus to the short-time consumer the difference of system is of no consequence; while to the long-time consumer it makes a decided bid. Meanwhile, the consumers of Glasgow Corporation gas are beginning to feel a little "out of it," because electricity at 1½d. per unit is equivalent to gas at 18d. per 1000 cubic feet.

THE VISIT OF THE INSTITUTION OF GAS ENGINEERS TO BERLIN AND COPENHAGEN.

ACCORDING to the Secretary's list, some forty-five members and friends of the Institution of Gas Engineers, and of the President, Mr. F. D. Marshall, were to form the party representing the Institution in Berlin and Copenhagen this year. A few—a very few—ladies braved the long railway journey, for which all possible arrangements tending to increase comfort and spare fatigue had been made. London to Berlin in 21½ hours, with dining and every other accommodation *en route!* It is a worthy achievement of railway management, for which most of the honour falls, it must be confessed, on the foreigner. Nevertheless, the boat train to Queenborough is not the worst of the English southern lines services. Faint praise, perhaps; but to be able to commend at all the English portion of a Continental service is certainly something.

A fine night and a good passage to Flushing. Thence a long journey through the flat country (not failing to remark in passing the extent of the coal and iron fields of Westphalia, and the thorough way in which the mineral wealth of the country is being exploited) to Berlin, where the party was met by the Reception Committee, composed of Messrs. H. W. P. Nugent, E. Thompson, P. S. Ledger, A. Hayman, and E. J. Hutchence. Next morning, according to the programme, there was a gathering of visitors and hosts at the Kaiserhof Hotel, before the start for the drive through the streets which was to finish at the Wannsee Station, for the place of the same name. So clean a city! Such wide spaces, allowing the massive architecture of palace and monument always to be seen to the best advantage! No antiquity anywhere—even the two or three old churches of which Berlin boasts smartened up so as not to be shamed by the brand-new edifices surrounding them. It was lighting-up time before the

party arrived, so that the first impression was that of a bright and beautiful city, all white *façades* and shining streets. The lighting of the Berlin thoroughfares is held up as a pattern to other cities; and for this reason it is satisfactory to record that it is all gas—incandescent, of course. There is a good deal of electric arc lighting by private users, as hotels and the like; and a splendid effect is produced by the free use of arc lamps at different elevations. All the best of the lighting is by no means on one plane; and this diversity is charming. There is a most liberal use of both gas and electric light in the main streets and the numerous wide open spaces; and as Berlin seems never to go to bed, it is no wonder that the night effect is something altogether different from anything that can be seen in staid England.

The favourable impression of Berlin received on Saturday night was more than confirmed on the following day, when, as already mentioned, the first of several most enjoyable drives was taken through the principal streets. This part of the entertainment of the visitors was provided by the German Association of Gas and Water Engineers, who had appointed a Local Committee to see to all the arrangements. The work was perfectly done, under the capable direction of Herr von Oechelhaeuser, ably assisted by Herr Streichert, Herr Salzenberg, Herr Blum, and other enthusiastic helpers in a duty which was evidently to them all a "labour of love." Sunday's excursion to Wannsee, Potsdam (lunch at the New Restaurant), and the drive and walk round and about the Court suburb, will never be forgotten by those who were privileged to take part in it. The banquet that followed, offered by the Gas Department of the Berlin Municipality, was a memorable function. Herr Stadtrath Namslau, Chairman of the Committee, presided, supported by many eminent personages connected with the Berlin City Government. The whole day was a great opportunity for the fraternization of German and English gas engineers—many previously well known to each other by name and repute, but now meeting in the flesh for the first time. Dr. Bunte was there; and, it is almost needless to say, he was met by all the Englishmen in the spirit of affectionate respect due to his great name in the world of gas.

On Monday the serious business of the meeting began, according to the programme, with a drive from the Kaiserhof Hotel to the Berlin Municipal Gas-Works at Schmargendorf—again through a beautiful part of this astonishing city. These works are laid out for a make of 4 million cubic feet of gas per day, and are under the immediate management of Herr Schimming, who, before he went there in succession to Herr Reisener, designed the Charlottenburg works, seen later in the day. Herr Streichert, the General Manager, did the honours of the station, which is a good example of German gas engineering. A striking feature of the works is the handsome gasholder-house, containing a holder having a capacity of 2½ million cubic feet. The brickwork and general disposition of the plant were greatly admired.

The party was next driven to the so-called English gas-works in the Gitschinerstrasse, belonging to the Imperial Continental Gas Association. The Chief Engineer, Mr. Drory, was absent; but he was represented by Mr. Nugent, who was able to show one of the best examples of inclined retort working in existence. The carbonizing here commanded general admiration. Next came lunch, at the Palast Hotel, offered by the Directors of the Imperial Continental Gas Association, and vastly enjoyed. The afternoon was devoted to visiting the Charlottenburg Municipal Gas-Works, under the management of Herr Muller, which is a monument of scientific gas engineering. Light refreshment was here partaken of, by the invitation of the Charlottenburg Municipality. A memorable feature of this function was a spontaneous tribute paid by the President—Mr. F. D. Marshall—to Dr. Bunte, whom Germany and England on this occasion united to honour for his life-work in advancing the science of gas manufacture. Such graceful acknowledgments go far to make friends of men of different nationalities. Thus ended the Berlin half of the trip, in a coruscation of mutual compliments. Never was anything of the kind better, more generously, or more heartily done by hosts, or more appreciated by guests.

The journey from Berlin to Copenhagen *viâ* Warnemünde and Gjedser was interesting, especially the passage of the Great Belt by ferry steamer conveying the saloon carriages on its deck. Denmark much resembles England in climate and scenery. The State Railway Administration had placed at the disposal of the party some of the best-appointed corridor coaches in Europe; and the baskets of refreshments with which the forethought of the President had arranged for the visitors to be supplied on the way, were a revelation of what can be done in this line. But, indeed, the means of refreshment provided for railway travellers throughout Germany and Denmark are infinitely superior to anything of the kind in England.

Copenhagen is so far like an English city that the shops shut comparatively early, and the streets at night are therefore without the animation and light of the thoroughfares of Berlin. It was noticeable that in the central portion of the city, lighted by the Municipality, flat-flame burners are still largely used. A programme going more into details than the official one previously circulated was put into the visitors' hands. The first appointment for Wednesday morning was at the Custom House Stairs, where a steamer was in attendance, by the kindness of Captain Drechsel, of the Copenhagen Harbour Board. The weather being brilliant, the beautiful harbour looked its best. After some little time had been spent in admiring the bright and busy scene, a start was made for the Free Port, to see the coal hoisting, storing, and retailing plant of the Danish Coal Company, described in Mr. Marshall's Gas Institution paper of 1897.* This impressive establishment was alone well worth the journey to see. Two colliers were lying alongside the quay; and the rapidity and ease with which the coal was being lifted by "grabs" out of the hold, swung aloft, dropped into trucks which automatically ran to where the coal was wanted to be stored, dropped their load, and were sent back to be refilled, was greatly appreciated by the professional company. It was a most instructive, but withal a very dusty scene, which can best be described in the fewest words by stating that the man with the shovel is practically superseded in discharging, handling, and distributing coal at the rate of 2000 tons per day, part of which goes to the works of the Danish Gas Company, while the rest is house coal. Coke also is dealt with here, not less than 30,000 tons from Beckton having been received for retailing. The grain store of the Free Harbour was next inspected, followed by a trip up the harbour to see the Temporley Coal Conveyor at work at the wharf of the Frederiksholms Fabrikker. In the afternoon, at the invitation of the Copenhagen Magistrates (represented by Herr Director Windfield-Hansen), the party drove to the Eastern Gas-Works of the Municipality, which are under the management of Herr Irminger. Here the excellence of the general working equipment, in which tar and water separators conspicuously figured, was noteworthy. At Strandvei a gasholder and tank on the Intze system were shown. The long day was very delightfully ended with a drive through the pleasant suburban district bordering on the Baltic to Skodsborg, where dinner was provided by the hospitality of the Copenhagen Municipal Lighting Committee.

Thursday morning broke with heavy rain. This made a slight variation of the programme desirable; and consequently, in order to get an hour under cover, the first visit was to the Royal Copenhagen Pottery, where some beautiful porcelain was displayed, and the processes of manufacture and ornamentation explained by the Herr Director Schau. Thence a move was made to the famous "automatic" gas-works at Frederiksberg, described in Mr. Marshall's paper of 1895.† These arrangements work perfectly. Here the Monier system of reinforced concrete construction, which Mr. Marshall has so largely adopted, was exhibited in all its stages. The principle of automatic working is carried all through these handsome works, to the point of there being no engine or governor man, but only a cleaner who goes through all the machinery. The governor is self-adjusting, on the "Ledig" system; putting on and taking off the pressure on the district as the demand increases or diminishes. The gas is carburetted by a Bunte apparatus, with benzol; some alcohol being added in winter by the Bueb apparatus, to prevent the freezing of the public lamp services. The works are very smartly kept; a good deal of aluminium paint being used for the lamp-columns and other "show" objects. It is in all respects a model establishment. Lunch was served on the works, by the hospitality of the Danish Gas Company, who also, in the evening, gave the last—and not the worst—dinner of the trip. The afternoon was gloomy; but the drive through the city, according to the programme, was carried through to the great content of all concerned. Friday was well occupied in private sight-seeing; and at the end of the week the party broke up—some returning to England direct, others making a short stay in Hamburg, and some few going yet farther afield. Thus ended the most protracted and happiest of all gas managers' associated excursions, with a chorus of thanks to all the numerous hosts for their inexhaustible hospitality, and to Mr. Marshall for his forethought, assiduity, and overflowing goodness of heart, which gilded all the proceedings, and made every individual experience a happy possession while memory lasts.

The Motion of Ground Waters.—Mr. Charles S. Schlichter has published, in the nineteenth annual report of the United States Geological Survey, Part II., a theoretical investigation of the motion of ground waters. He investigates the laws of motion of water through the interspaces of an agglomeration of equal spheres, and also discusses the general laws of flow of ground waters. In connection with the motion in horizontal planes, the well-known transformations by conjugate functions are applicable; while the lines of flow in problems relating to the mutual interference of two or more wells are closely analogous to the corresponding lines in two-dimensional hydrodynamical problems involving sources and sinks.

Electrolysis of Gas and Water Pipes.—In our "Legal Intelligence" to-day, reference is made to a case in which an injunction was obtained by a Gas Company against a Railway Company who had caused electrolysis of the gas-pipes in consequence of the defective bonding of the rails. Similar trouble has arisen to gas, water, and hydraulic companies in Sydney (N.S.W.); and a paper was recently read thereon before the Electrical Association of New South Wales. It appears therefrom that particular attention is being paid on the Sydney electric railway tracks to the prevention of current leakage from the rail return. The bonds are of the Edison-Brown plastic type; and a supplementary return is being provided in the shape of a copper cable having a section of 0·45 square inch.

* See "JOURNAL," Vol. LXIX., p. 1120. † *Ibid.*, Vol. LXV., p. 1245.

RECENT NOTEWORTHY JUDGMENTS.

From an article in the "Law Times," recalling some of the noteworthy decisions of the judicial year recently ended, we select the following judgments as being of interest to the managers of large commercial undertakings, more especially in their capacity as employers of labour. Some of the cases have been already noticed in these columns; but it may be useful to briefly recall and classify them for future reference.

Workmen's Compensation Act. As is but natural while this Act is passing through the "interpretation stage" which awaits all measures dealing with a subject so many-sided as that of employers' liability, the decisions to be noted under this heading are numerous.

The employer was held to be liable under the Act in the case (*a*) of a workman employed in a ship alongside a dock who was killed by the explosion of some goods which he was placing in a basket in order that they might be hauled ashore. This was regarded as an accident arising out of and in his employment on or about unloading machinery. Similarly, in the case (*b*) of a workman injured in a cart standing close to the entrance to his factory, the employer was found liable. On the other hand, a carter injured one and a half miles from the factory (*c*), and a workman killed on board a hopper carrying out to sea mud dredged from a harbour works (*d*), had no remedy.

As regards the provisions in respect of buildings 30 feet high, the Court of Appeal have held (*e*) that the Act does not apply to structures intended to be, but not at the time of the accident having actually attained, that height. In the case of a building 28 feet high from ground to parapet, but 36 feet to the ridge of the roof, which was being strengthened by introducing some iron stays, it was held (*f*) that the building exceeded 30 feet in height, but that it was not being "constructed or repaired," and did not, therefore, come within section 7. The Act applies to buildings less than 30 feet high if there be machinery, driven by mechanical power, used for the purpose of construction, repair, or demolition (*g*).

Two important cases have dealt with the method of computing the workman's earnings. The first (*h*) decided that when a man's wages have been increased during the twelve months prior to the accident, compensation must be calculated on his average wages during that period; the second (*j*) laid it down that where, during the twelve months preceding the injury, the workman had been some time at work for the employers, then some time on strike—the employment being concluded by notice—and then again in their employment, regard must only be had to the wages earned since his re-engagement.

Law of Master and Servant. The following cases dealt with more general aspects of the relations between employers and employed. The first two may also be classed among trade-union cases.

In the first (*k*) the Court of Appeal aimed a deadly blow at picketing. By the Master of the Rolls and Lord Justice Chitty, the doctrine was laid down that watching premises to compel a man to do or not to do lawful acts is wrongful (unless reasonable justification can be shown), and that for two reasons: Firstly, because section 7 of the Conspiracy and Protection of Property Act, 1875, makes it an offence; and, secondly, because it is a nuisance at common law, for such conduct seriously interferes with the ordinary comfort of human existence and the ordinary enjoyment of the house beset. The leading House of Lords decision in trade union cases, *Allen v. Flood*, was held not to touch this point.

In the second case (*l*), the question arose as to the applicability of "watching and besetting" to attendance of workmen at a landing-stage to persuade imported workers not to enter the service of certain masters. This was held to be within the Act; being intended to compel the masters to conduct their business in accordance with the wishes of the men, and not merely to communicate information.

As to the standard of care required of servants having the handling of delicate and valuable machinery, it has been decided (*m*) that if a servant make but one mistake, under certain circumstances, the master's interests may be so imperilled that he may be justified in dismissing the servant without notice. A single act of forgetfulness in the case of a printing machine, value £800, damaged the master to the extent of £30. At first sight, says the "Law Times," the decision seems hard on the workman; but on second thoughts it is clear how many servants' lives may be endangered by the thoughtlessness or stupidity of one man in charge of the complicated machinery of modern times, and, therefore, in the men's own interests, as well as in those of the master, the Court now declares that forgetfulness, even when not habitual, may amount to neglect justifying instant dismissal.

Relief from the Rates for Men on Strike. In the case of *Attorney General v. Merthyr Tydfil Guardians*, it was sought to have it declared that Guardians of the Poor have no right to grant relief to able-bodied men wilfully refusing the means of earning their support. The Court of Appeal held that if such able-bodied men were in point of fact destitute, the Guardians' province was to relieve; but that, when the urgent pressure of want was removed, the men must work or be prosecuted under the Vagrancy Act, 1824. The proper course for ratepayers desirous of challenging the Guardians' conduct is to set in motion the Local Government Auditors, with an appeal to the Board itself if required; it being held that the Courts ought not to intervene except under special and peculiar circumstances. We should have thought that the circumstances of this case, arising out of the relief of the Welsh coal-miners when on strike in 1898, were both special and peculiar to a considerable degree.

Assessment of a Reservoir. The case of *Liverpool Corporation v. Llanfyllin Union* (*n*) is likely to be often cited, more especially in view of the extensive additions proposed to the existing water systems of our great cities. The Corporation here had constructed, under an Act of Parliament, a large reservoir in Wales, involving the total submersion of a church, vicarage, schools, roads, and bridges; a new church, vicarage, and so forth, being substituted for those so destroyed. The question arose whether the assessment to the poor rate should be based on the estimate of the amounts expended in providing these substituted buildings and facilities, or whether they should be excluded from the calculation. The Divisional Court held that none of these expenses should be included; but the Court of Appeal reversed the judgment, on the ground that they must look to the total amount which the Corporation deemed it worth their while to spend—regard, of course, being had to any expenditure which could be shown to be obviously unnecessary or wasteful. No suggestion was made on this score in regard to any item appearing in the case. Under what circumstances, we wonder, would a water undertaking be likely to enter such a plea?

Extraordinary General Meetings. An important and practical decision was arrived at by Mr. Justice Kekewich with regard to notices sent out of extraordinary general meetings (*p*). Such notices must disclose all facts essential to a shareholder's deciding whether he ought, in his own interest, to attend the meeting; and the fact that a director is financially interested in a resolution to be proposed is exceedingly material.

Illicit Commissions. In a case of illicit commission over the purchase of a horse, it was held (*q*) that it is not necessary to inquire into the effect of a bribe. Its offer and acceptance were sufficient to invalidate a veterinary's certificate of soundness.

a. "Woodham *v.* Atlantic Transport Co." (79 *Law Times Reports*, 395; [1899] 1 Q.B. 15).
b. "Powell *v.* Brown" (79 L.T.R. 631; [1899] 1 Q.B. 157).
c. "Lowth *v.* Ibbotson" (80 L.T.R. 341; [1899] 1 Q.B. 1003).
d. "Chambers *v.* Whitehaven Harbour Commissioners" (80 L.T.R. 586; [1899] 2 Q.B. 132).
e. "Billings *v.* Holloway" (79 L.T.R. 396; [1899] 1 Q.B. 70).
f. "Hoddinott *v.* Newton, Chambers, & Co." (80 L.T.R. 558; [1899] 1 Q.B. 1018).
g. "Mellor *v.* Tompkinson & Co." (79 L.T.R. 715; [1899] 1 Q.B. 374).
h. "Price *v.* Marsden & Sons" (80 L.T R. 15; [1899] 1 Q.B. 493).
j. "Jones *v.* Ocean Coal Co." (80 L.T.R. 582; [1899] 2 Q.B. 124).
k. "Lyons *v.* Wilkins" (79 L.T.R. 709; [1899] 1 Ch. 255).
l. "Charnock *v.* Court" (80 L.T.R. 564; [1899] 2 Ch. 35).
m. "Baster *v.* London & County Printing Works" (80 L.T.R. 757 [1899] 1 Q.B. 901).
n. 80 L.T.R. [1899] 2 Q.B. 14.
p. "Tiessen *v.* Henderson" (80 L.T.R. 483; [1899] 1 Ch. 861).
q. "Shipway *v.* Broadwood" (80 L.T.R. 11; [1899] 1 Q.B. 369).

COMPULSORY LICENCES.*

It is a noteworthy sign of the growth of specialism in the practice of English law, that a substantial volume should be devoted to the exposition of one section of the Patents Act of 1883. This is the celebrated Section 22, which introduced the principle of compulsory licences under letters patent. Our readers will remember that this provision of the last Patents Act remained dormant for upwards of fifteen years. In the meantime, a grievance against the operation of the law was loudly complained of, chiefly in connection with the Manchester chemical industry. It was asserted that the commercial interests of this country suffered from the absence of the requirement, common to the patent systems of several countries, that patented inventions should be worked within the country. Foreign patentees, it was plausibly alleged, could take out English patents, and so monopolize the trade in the subject-matter, without being under the obligation to work the patents themselves. The evil was complained of especially in respect of the coal-tar colour and drug industry, which is largely in German hands. Meetings of the chemical trade were held to discuss this grievance; and at last a very creditable "movement" for the reform of the English Patent Law was set going in Manchester, and extended to the length of a deputation to the Board of Trade. Here, however, it encountered an unexpected check. It was the Board of Trade that had most to do with the framing of the Act of 1883. In this Act, the Continental principal of compulsory working was not embodied, on the best expert advice; but instead of it an altogether new rule was adopted, making patentees liable to issue licences under compulsion, if the Board of Trade thought fit to require it of them. The Manchester malcontents were politely asked if their attention had been drawn to this provision. They replied to the effect that they knew of it, but had regarded the clause as a dead-letter. To this condemnation the Department

* "Compulsory Licences under the Patents Acts." By J. W. Gordon. London: Stevens and Sons, Limited.

demurred, on the reasonable ground that it had never been asked to set the law in motion. The deputation was told that it would be time enough to talk of the compulsory licence clause being dead after it had been proved so in fact. "Give the clause a trial," said the Department in effect, "and then come again."

The advice was taken; and then many noteworthy circumstances came to light. It was quickly seen to be a very strong interference with the rights of property to require a patentee to part with his exclusive privilege of doing as he pleased with his own. Mr. Gordon does not hesitate to confess that for some years after the clause became operative lawyers generally overlooked its existence. They had become so habituated to regard the High Court as the authority in patent matters, that they never thought the Board of Trade could usurp its powers in the important respect of licencing. The High Court has the right of dealing with compulsory licencing in this way: No patentee can assert his patent right against an infringer except through the Court, which is usually moved by way of application for an injunction. The Court has absolute discretion to grant or withhold the injunction; and it is a fair defence of infringement that the patent is being used in restraint of trade or to the prejudice of the public. But, Mr. Gordon points out, the practice of the Court in recent years has been to abandon this branch of its jurisdiction. The judgment in the case of *The Incandescent Gaslight Company v. Cantelo* is cited to show that the Court has "even formally declined to entertain any question of the public convenience as against the pretensions of a patentee." Mr. Gordon seems to hold a brief for "the public" against patentees; for he protests strongly against the recent manner of dealing with "small infringers" by committing them to prison. In this passage, he seems to refer to the "black bag" smugglers of incandescent gas-burner mantles.

The true question in this connection is, What is the precise nature of a patentee's rights in respect of the patented invention? and the query, although easy to put, is difficult to answer without exhaustive inquiry. We cannot follow Mr. Gordon through the historical investigation which leads him to define the consideration for which the State grants a man a patent as "the introduction and establishment within the realm of a new manufacture." This is a very important deduction, making patent right conditional, and not absolute. The patentee is granted his monopoly on the condition that he promotes the new manufacture. In default, the patent might be forfeited under the old Statute of Monopolies. But the Act of 1883 has introduced a milder remedy, and empowered the Board of Trade "to proceed by way of correction and to guide the patentee into the proper discharge of his functions without exacting the extreme penalty of his offence."

Hence the section speaks of the "default" of a patentee to grant licences—the word indicating that this is not a matter of choice, but of obligation. The powers of the Board of Trade are not punitive, but corrective. It is not surprising, however, that the first attempts to set the new principle in action were attended by enormous difficulty and expense. The Board of Trade did not encourage applications for compulsory licences that were not seriously meant; and inquiries into the grounds of such appeals cost much money. Naturally, it is the commercial side of patent right that comes uppermost in connection with such proceedings. People do not want compulsory licences "for fun." But it can rarely be an easy matter to assess fairly the terms upon which a patentee shall grant a licence to an applicant who is necessarily a trade rival. Sometimes the importance of such a permission to both parties may be such as to throw into the shade every other consideration arising out of the patent. One can easily imagine a patentee saying "If I am compelled to grant a licence to so-and-so, I may as well give up my patent at once."

Yet it must be conceded that both British and American experience justifies Clause 22. It aims at destroying the greatest evil of all patent systems—the obstructive maintenance of patent rights. A patent is obstructive when it is not being worked at all, or when it is not being worked on a sufficiently large scale to meet the public demand; or when it controls another man's patent. In any such case the Board of Trade may grant relief upon just and reasonable terms. In connection with this part of the subject, there arises the consideration of the right of a patentee to impose conditions on purchasers or licensees. Mr. Gordon warmly discusses the judgment in *The Incandescent Gas Company v. Cantelo*, already named, in which the seller's attempt to establish an exclusive trade in an unpatented article, by making the purchase of it from himself and at his own price a condition of the sale of the patented article, was upheld in the strongest language.

It is remarkable that no sooner had the vitality of Clause 22 been established by Levinstein's application than various petitions were lodged; some of the commercial issues being of great importance. One of the cases reported by Mr. Gordon was the abortive attempt of the Continental Gluhlight Company to get a licence from the Welsbach Company. Altogether, the more the matter is looked into the clearer it appears that proceedings under Clause 22 are a very serious branch of Patent Law practice, the importance of which is only beginning to be understood. Indeed, it is not too much to say that the development of this new departure may revolutionize not only patents, but even inventions. It alters the datum. An inventor may start where his forerunner has left off, with the confidence that the latter cannot play him the trick of the "dog in the manger." This is a fact of enormous significance. The interest of the public will tend to gain, and the monopoly of the patentee to shrink. In all cases of doubt, the Board of Trade will act for the promotion of industry; and the industry will be its first care. This consideration also affects Mr. Gordon's complaint, of the legalization of conditional licences. If the condition is against public polity, or in restraint of trade, it must go.

Consequently, the subject-matter being of such moment, we are glad to be able to recommend Mr. Gordon's book as an indispensable guide to the practice of Section 22. Ignorance of the law, as the old saw informs us, excuseth no man for breaches of it. We are now arrived at the point of requiring a whole text-book to expound one clause of an Act of Parliament. It is as though a dictionary were called for in respect of every word of a language. Yet inasmuch as the most detailed and elaborate dictionaries, histories, and grammars are really the simplest, safest, and most intelligible, there is much to be said in favour of this novelty of a separate law-book for one clause of an Act of Parliament. But such a clause! There's the point. It is a new organic law, expressing in the letter an unwritten rule of the law that dates as far back as the reign of Queen Elizabeth; now for the first time, thanks to Mr. Gordon, made perfectly intelligible.

PERSONAL.

The net personal estate of the late Mr. FRANCIS BASSETT, J.P., who was a Director of the Imperial Continental Gas Association, has been valued at £103,791 7s. 4d.

Mr. ALFRED TODD, who has been the Secretary of the Whitby Gas Company since its formation, has been unanimously elected a member of the Board on his retirement from the secretaryship. Mr. W. M. GALLEWAY, who has been in the service of the Company for a number of years, succeeds Mr. Todd.

Mr. JAMES DAWSON, who has been for four years Manager of the West Calder Gas Company, has been appointed Manager of the Auchterarder Gas Company, in succession to Mr. J. W. Napier, transferred to Carnoustie. The Directors of the West Calder Company gave Mr. Dawson a very high recommendation.

The office of Borough Accountant to the Oldham Corporation has become vacant through the appointment of the present occupant (Mr. Dyer) to a similar position in Belfast; and at the meeting of the Finance Committee last Thursday, the question of his successor was practically settled. Mr. ARTHUR ANDREW, the Superintendent of the Gas and Water Departments, has been offered the post; and, his reply being a favourable one, the Committee determined to recommend his appointment to the Council. If this is confirmed, the Borough Accountant's staff will be transferred to the offices of the departments over which Mr. Andrew already presides.

OBITUARY.

The Boards of the Runcorn Gas and Water Companies have just lost a member—Mr. WILLIAM WHITTAKER—who had reached the advanced age of 81 years.

The death is announced of Mr. J. NEVILLE CHAPMAN, the first Manager of the Grimsby Water Company. He held the position from 1864 to 1884, and was Consulting Manager up to the time of his decease. He was 75 years of age.

The Lords of Appeal in Ordinary have lost one of their colleagues in the person of Lord WATSON, who died last Thursday at the age of 71. His Lordship's name is associated with several important decisions in connection with the Employers' Liability Act, 1880; and his judgment in the well-known Trade Union case of *Allen v. Flood* was a valuable contribution to the solution of the difficult question involved.

Incandescent Gas for Church Lighting at Shanklin.—The church of St. Saviour, Shanklin, is now lighted by the incandescent gas system; the installation consisting of 37 burners fitted with automatic igniters. The old plan of lighting the church necessitated the use of 112 burners, which consumed 560 cubic feet of gas per hour, giving illumination equal to 1792 candles; while the new burners consume 148 cubic feet per hour, and give the equivalent of 3500 candles—every part of the building being thoroughly and evenly lighted. These figures show the cost for gas to be less than one-fourth, while the light is as nearly as possible doubled. The lighting of the chancel, which was carried out in accordance with a suggestion made by the Vicar, is quite a novelty, and has been found to work most satisfactorily. It is manipulated by a simple arrangement at the back of the reading-desk, and operated without calling for any assistance from the church officials. The effect of the light upon the altar is very brilliant, as no burners are visible from the nave. The installation was designed by, and has been completed under the supervision of, Mr. Frank C. Taylor, Manager and Secretary of the Shanklin Gas Company (who also designed and erected the apparatus for blowing the organ with an "Otto" gas-engine some time since); the work being carried out entirely by the Company's employees.

TECHNICAL RECORD.

WAVERLEY ASSOCIATION OF GAS MANAGERS.

Half-Yearly Meeting at Melrose.

The Seventy-seventh Half-Yearly Meeting of the above-named Association was held in the Station Hotel, Melrose, on Thursday last—Mr. W. B. M'Lusky, of Selkirk, the President, in the chair. There was a good attendance of members.

The Hon. Secretary *pro tem.* (Mr. A. C. Young, of Kelso) submitted the minutes of the previous half-yearly meeting; and they were adopted.

Next Year's Meetings.

A letter from Mr. J. C. Adamson (of Airdrie) was read, in which he regretted his inability to be present to enjoy once more companionship with the members. He suggested that next year—the century year—one of the meetings of the Association might be held in the good old town of Kelso, and in, if he remembered rightly, what was 38½ years ago called the Queen's Head Hotel, the cradle of the mother of Gas Managers' Associations, the good old Waverley, when he should make a point of being present to see the old birthplace.

Mr. D. Vass (Airdrie) thought that the end of the century had nothing very clear to do with the Association, and that they should not lose sight of the idea of meeting in the President's town. He moved that the meeting next April be held in Selkirk.

Mr. J. M'Laren (Duns) seconded the proposal, and it was agreed to.

On the motion of Mr. M'Laren, seconded by Mr. H. Rutherford (Aberlady), it was resolved to hold the September meeting in Dalkeith.

The President's Address.

The President then delivered the following address:—

Gentlemen,—What London is to the Incorporated Gas Institute, and Glasgow to the North British Association, Melrose may be said to be to this Association of country gas managers, which bears the immortal name "Waverley"—at once the most central and attractive part of the district from which we draw our members. I trust that we may have a most profitable and pleasant time in this ancient and historic place to-day. Our meetings may be likened to a family gathering. The hearty Scotch hand-shake, the homely chat, the free-and-easy, yet earnest, discussion of business matters, and the loyalty towards each other which has ever characterized the members of this old Association, have all contributed to bring it successfully down through all those thirty-eight years of its existence, without either rules, regulations, or bye-laws of any kind.

Many of the old members have passed away since the last meeting here. The front rank has been reduced to the active "member for Jedburgh," and the retired "grand old man" of Haddington, the holder of the President's medal in the two oldest Gas Managers' Associations in the world, and one of the few men now living who took an active part in the famous Flintoff gas controversy. Fresh troubles beset us. The fame of Border gas men, like that of Border divines, has been spread abroad in the land. It is not enough that we lose our old members—our young men are being "called." Even since we last met, two of our members have gone West in response to the call of promotion. We rejoice in their advancement, while we regret the loss our Association has sustained by their translation.

The record attendances which we have had at recent meetings is very gratifying. The growing desire on the part of gas managers in this district to meet with each other for the interchange of opinion is one of the healthiest signs of improvement. It is calculated to help, not only the individual member, but also the company he serves. A feature of our spring meetings in Edinburgh lately has been the visits paid to engineering works in the city; and our thanks are due to those firms of gas engineers who so kindly threw open their works for our benefit on those occasions.

I am called upon to-day to bring under your notice subject-matter calculated to provoke a profitable discussion; and it has occurred to me that there is no question which would be so valuable for this purpose as a review of the working details of small gas-works, such as we represent. I shall therefore confine my remarks to small things.

In days gone by, the work of the gas manager consisted chiefly in making and delivering gas to the consumer; the latter being left to make use of the commodity to the best of his limited knowledge of gas economy. To-day, if we are to hold our own in competition with the perfected mineral oil-lamp, and the more effective—if more expensive—illuminant, the electric light, we are bound, not only to supervise the fittings and burners of consumers, but must also fix suitable burners free of charge, in order to secure to our customers the greatest possible amount of light for their money. Further, we must popularize the use of gas, and employ every legitimate means in our power to have it introduced for purposes other than lighting, so that, being fortified by a good going business, we may hold the field against all comers. The sphere of labour is greater to-day than it was in former times. In large undertakings, the work is distributed over many officials and workmen; every man to his particular branch; but in the small country gas-works, the whole work devolves upon one individual—the manager, who, to be successful, must zealously set himself the task of overtaking this extra work, and be untiring in his efforts to attain a measure, at least, of the success of the larger undertakings, in the management of which the best skill in the land, the most efficient apparatus and labour-saving appliances, and the smartest business methods are brought to bear. If the small works are to advance in the same ratio as the large, we must, while making the most of our present opportunities and working the plant which we have to the best advantage, carry out, year by year, as funds will permit, such improvements as will bring the works into line with modern practice; all new apparatus being set down from a complete plan of general improvement.

I have indicated that the manager of a small works is handicapped in the race. Let us inquire into ways and means of reducing this handicap. We shall consider, in order—

1.—Carbonizing.
2.—Coal: The selection of suitable coal for gas-making purposes, and the effect of the recent advance in prices.
3.—Temperature and purification.
4.—Unaccounted-for gas.

While it is now admitted that gaseous firing is the best system for medium-sized and large works, open firing predominates in small works; and its use is supported on the ground that, notwithstanding the waste of material and labour which it involves, as compared with regenerative firing, the ultimate cost of the gas per 1000 cubic feet into the holder, including wear and tear charges, is equal to that obtainable by the more scientific system, *plus* charges for interest, depreciation, and cost of renewals. With this opinion I entirely disagree; knowing, as I do, the carbonizing returns under each of the systems of working in this district. And I may here point out that profits rise more rapidly under the regenerative system in this locality, where coal is high in price and coke correspondingly dear, than is the case in Central Scotland, where coal is comparatively cheap and coke a glut on the market. Let me make a comparison. One of the most serious drawbacks to good carbonizing results in small works is intermittent working. As a rule, gas is made for twelve to eighteen hours per diem. Carbonizing is suspended, and fires are banked up during the night, with the result that in the morning the temperature of the oven is down, and hard firing is necessary for several hours before charging can be commenced. Some 7000 cubic feet per ton of coal is reckoned a fair average for the first "round." The consumption of fuel is abnormally high all day; and only towards evening, when "banking-up" time is again approaching, is a satisfactory working heat obtained. The same set of circumstances is reproduced when, in a very small works, the manager has to fill up the furnace with cold coke, reduce the damper openings, and leave the works for several hours on end to attend to main laying, meter survey, or an urgent call to one or other of his manifold duties. With the regenerative system, on the other hand, absolute control over the air supply is obtained. Damper openings and primary and secondary air-passages may be reduced, and carbonizing suspended for several hours, without any appreciable loss of heat—and that with an extremely moderate consumption of fuel. The net saving over the year, with a make of 3 million cubic feet, is equivalent to 1000 cubic feet of gas per ton, *plus* the revenue from 25 additional tons of coke sold, or in all £88. This sum is sufficient to pay off the initial cost of the bench of retorts in two years, and *thereafter* to meet a reduction in the selling price of gas equal to 7½d. per 1000 cubic feet, not to speak of the saving in labour and the freedom from the anxiety and worry which are associated with the open fire, especially in small works.

Gas managers have been exercised more than usual this year with regard to coal supply, on account of the abnormal rise in price. Here, again, works equipped with a thorough recuperative system of heating retorts have occupied a strong position; for it is noticeable that the kind of coal which has advanced most in price belongs to that class which is indispensable for the production of coke suitable for the open fire. Nothing concerns the manager of a gas-works more than the selection of coke suitable for his furnaces. Coals producing excellent residual coke must, in many cases, be had, independently of the quality of gas which they yield; otherwise low heats or hard clinker will prevail. Such coals are good value for the money in the localities in which they are raised; but, coming into this district with 60 to 75 per cent. added for railway dues, they are unprofitable in the extreme. With gaseous firing, we find that a high temperature can be maintained in the ovens with a mixture of coke containing an average of 10 per cent. of ash produced from cannels yielding a rich illuminating gas, and thus reducing the cost of enrichment. Upon such cannels the charge added for railway carriage amounts only to 33 per cent. of the prime cost. True, a certain amount of care must be exercised in the building up of a mixture of coals which will produce a coke containing an ash which will not hinder the free access of primary air to the producers with a moderate draught. The supply of this description of coal is plentiful; and wherever it can be employed, the illuminating power of the gas may be maintained, while the cost of production is reduced and the quality of the saleable coke improved. The following comparative statement of the relative values of several coals, based upon prices f.o.r. at Selkirk and working returns at the gas-works there, will serve to show that the cost of such coals per candle per 1000 cubic feet is less

than that of those whose only claim to our attention is the excellent coke which they provide for our furnaces:—

Class of Coal.	Year.	Gross Cost of Coal per 1000 Cub. Ft. into the Holder.	Cost per Candle per 1000 Cub. Ft.	Ash per Cent. in Coke.
1.—First-class cannel, 32-candle power	1897	2s. 0·26d.	0·75d.	7
	1899	2 1·3	0·79	7
2.—Second-class cannel, 27-candle power	1897	1 7·2	0·70	7
	1899	2 0·4	0·90	7
3.—Second-class cannel, 27-candle power	1897	1 5·2	0·63	10
	1899	1 6·5	0·68	10
4.—Third-class cannel, 23-candle power	1897	1 5·6	0·76	5
	1899	1 8·8	0·90	5
5.—Whole seam coal, 21-candle power	1899	1 4·3	0·77	5

You will observe that during the past two years—

1st-class cannel has advanced at the rate of 1·1d. per 1000 cubic feet.
2nd " " (good coke) 5·2d. " "
2nd " " (inferior coke) 1·3d. " "
3rd " " (excellent coke) 3·2d. " "

Coals producing good coke have advanced most in price whereas those yielding a large volume of rich gas have been least affected. This is doubtless due to the adoption, within recent years, of oil-gas enrichment and carburetted water-gas, processes, and the increased consumption of steam coal consequent upon the prosperous state of the iron trade of the country. The effect has been to increase the demand for splint-coal-parrot, and coals of the splint class generally, while reducing our requirements of the richer cannels. The result to the gas manufacturer is an advance from 0·76d. to 0·90d. per candle per 1000 cubic feet in the price of third-class cannel (taking prices delivered at Selkirk), while that of first-class cannels stands at 0·79d. Such a revolution in values ought to impress upon us the importance of the law that the only safe guide to the purchase of coal is the value in sperm which the penny will bring. While the foregoing table was not intended to illustrate the effect of a judicious combination of coals in the way of securing the maximum amount of light at the minimum of cost, it will serve as an example in this direction. No. 4 is a 23-candle power coal, producing this quality at the rate of 1s. 8·8d. per 1000 cubic feet into the holder; the value being 0·90d. per candle per 1000 cubic feet. Nos. 1, 3, and 5, combined in equal proportions, produce 466 cubic feet more gas per ton, and give an average illuminating power of 27 candles; the cost per 1000 cubic feet into the holder being 1s. 8d., and the cost per candle per 1000 cubic feet 0·74d. I would repeat that this is merely an example, for the purpose of directing attention to the value of building up mixtures of coke for firing purposes.

I may add that I have, during the past eight years, employed mixtures similar to the above with generator and regenerator settings, always with satisfactory results, but particularly so with the full-depth regenerator. The enhanced illuminating value obtained by mixing several coals together in the same retort is appreciated all round; but the benefits attending the employment, in suitable producers, of coke high in ash, made from the richer cannels, which increase the illuminating power of the gas at a reduced cost for coal, have not been so widely recognized. In small towns particularly, where it is a difficult matter indeed to sell gas at a low price per 1000 cubic feet, the advantages of such a system as a means of at once increasing the illuminating power and durability of the gas should not be lost sight of—especially as the consumer considers more the quarterly account than the technical price per 1000 cubic feet. And while we do aim at a low selling price, with the view to the more general adoption of gas for purposes other than lighting, we must bear in mind that, so long as the top candle is value for the money which the consumer pays, the policy of supplying rich gas is the right one, whether for lighting, cooking, heating, or motive-power purposes.

Let me now direct your attention to the advantages of maintaining the temperature of the gas at about 60° Fahr. in its passage from the foul main to the station meter. We have all observed how rapidly the illuminating power falls on a cold winter night, and at what a cost the required standard of light is restored and maintained. In my first charge, I found a condenser without a bye-pass, and the foul main unprotected in the open air; and I had recourse to the expedient of unsealing the condenser-box, and passing the gas direct to the outlet without traversing the pipes. The effect of this, and the wrapping up of the exposed pipes through which gas was passing, was remarkable. The temperature of the gas was kept at a normal degree throughout the winter; the make of gas per ton of coal was increased; while the illuminating power was maintained with a reduced cost for enriching material. As a makeshift, nothing could be better or more quickly carried into effect. All that is necessary is a pipe and tap of sufficient area, connected at a point near the bottom of the condenser-box, sealed in an open seal-pot, and having communication with the tar-well for the carrying off of bye-products as deposited. The tap may be closed and the ordinary process of condensation resumed at will. A proper system of bye-passing should, however, be introduced at the earliest opportunity. I continue to safeguard the temperature, and have within recent years employed slightly heated ammoniacal liquor in condensers and scrubbers for this purpose, with successful results; the temperature of the gas at the scrubber outlet ranging from 55° to 60° Fahr. in winter. The treatment of the crude gas—first with weak liquor, secondly with strong liquor, and finally with clean water, in order to arrest part of the carbonic acid (CO_2), break up the sulphur compounds, and effect the complete elimination of the ammonia—is a process which has been entirely neglected in our small works, and has not received the attention which it merits in works otherwise well equipped.

That it pays to employ washers and scrubbers of an approved kind, or one piece of apparatus capable of accomplishing both objects, has been established beyond a doubt, both as regards the quality of the gas produced and the facility afforded for bringing up the strength of the ammoniacal liquor. In a district like ours, where railway carriage is a heavy item, the importance of sending away highly concentrated liquor, and thus procuring a better price, cannot be too strongly urged. For the larger works, the apparatus referred to is made ready to hand; but in the case of very small works, unfortunately, there are many drawbacks to the installation of a proper system. Here is another opportunity for the exercise of that ingenuity which so readily comes to the aid of the working manager. Why not take advantage of the elevation at which the bulk of the virgin liquor is produced, collect it in suitable tanks, and, having allowed the temperature to fall to that point which will be sufficient to maintain the gas in the scrubber at 60° Fahr., pass the liquor through the scrubber on its way to the well. It is not necessary, though often convenient, to pass the hydraulic main and condenser liquor to an underground tank after leaving the separator, thereafter returning it to the scrubbers with the pumps. Neither is it essential to have the separator underground. You discover these things when you have no pumps—"Necessity is the mother of invention." The greatest amount of discrimination is necessary, however, in the selection of a washer or scrubber, for many forms of these not only increase the back-pressure, but also materially reduce the illuminating power of the gas.

With regard to dry-lime purification, I find that wherever Mr. G. R. Hislop's rule of 3 square feet of purifier area per 1000 cubic feet of gas made per diem is observed, there is no trouble whatever. When, however, the size of the purifier-boxes is reduced to half of this area, there is no end of anxiety and worry in connection with this most important part of our work. Further, I am of opinion that in every works making gas six days in the week there should always be three vessels in action, and a fourth standing off to clean, which may be filled leisurely, and remain ready to be turned on at a moment's notice. In this way, immediately the second vessel is sulphided it becomes the first of the series, with two clean purifiers always in front.

One of the most unsatisfactory features of our returns is, in my opinion, the large proportion of our production of gas which remains unaccounted for. The fact that leakage can be reduced to a very low figure has been brought home to us time and again; showing that a vigilant oversight of the mains and service pipes and connections has its reward. A valuable aid to the manager and his staff is the practice of rewarding with the trifling premium of 1s. the messenger who reports an escape of gas. It has been carried on in Selkirk during the past two years with very satisfactory results; the amount of gas unaccounted for having been reduced from 10·8 per cent. to a trifle under 8 per cent. Our system of locating a leak is the application of Parker and Lester's gas-leak indicator to gas and water tobies, and to holes made in the ground with the search-rod. Shrinkage of bulk contributes to the unaccounted-for gas; and over it we have very little control. When we advise consumers to safeguard their meters against frost, by carefully wrapping them up, we have used the only means in our power for keeping up the temperature there. In the autumn of 1897 I had thermometers fixed in our manufacturing mains at Selkirk, and made a note of the temperature there and at several points on the distributing system from time to time throughout the succeeding season. I found the latter ranging from 35° to 40° Fahr. in winter; while the thermometer at the station meter recorded 55° to 60° Fahr., the temperature of the apparatus leading thereto being under control. We have here a difference of 20° Fahr., which, reckoning the expansion of aëriform bodies at $\frac{1}{491 \cdot 4}$ of their bulk, at 32° Fahr., or, roundly, 1 per cent. for every 5° Fahr.—the rule laid down by Mr. Newbigging—represents a difference of 4 per cent. in favour of the consumer during the season in which half of our yearly output is sold. And this is no uncommon experience. The largest contributor to unaccounted-for gas is, in many instances, the consumer's faulty meter. The cure for this is the old one—systematic testing and renewal and the introduction of larger sizes than we generally find in use in these parts. Besides these forms of unaccounted-for gas there are many others, which, combined, make it impracticable to lay down a rule, and say that the amount of loss under this head should not exceed a certain limit. It may be argued that a proper basis of calculation is only arrived at when the daily readings of the station meter are corrected to the normal temperature and pressure. This course might be pursued farther, and allowance made for meter-outlet pressure; but an infinitely better plan for the purpose of estimating loss by leakage would be that of keeping a daily record of the temperature of the gas at the governor outlet, which should be compared with the temperature at the station meter, and the discrepancy due to shrinkage brought out approximately. The vital point, after all, is the quantity of gas sold per ton of coal carbonized—having due regard to the cost of the gas into the holder—and as a contribution to the discussion, I give the figures

for Selkirk for the year ending in May last, which includes arrears, thus reducing the statement to one of gas sold and paid for per ton of coal carbonized—

	Cubic Feet per Ton of Coal Carbonized.
Gas made	10,313
Gas sold and paid for	9341
,, sold but not paid for	44
,, used on works	103
Total accounted for	9488
,, unaccounted for	825
	10,313

There are several other important matters which I should have brought before you to-day had time permitted, particularly the progress of the gas-stove and coin-meter business in Selkirk, the effect of fixing consumers' burners free, and the advisability of gas companies fitting up and maintaining free of cost a large proportion of incandescent burners in the street-lamps. The public-spirited action of my Directors in fitting up one-third of the public lamps in Selkirk in this manner, has been highly appreciated by the community. These are questions which I propose to open up at our spring meeting next year, all being well.

I have endeavoured to-day to focus your attention upon what I believe to be the essentials to success in the managemant of small works. Managers of such works labour under many difficulties; but, in the carrying out of the operations to which I have referred, there is no reason why we should not emulate the best working returns in the country. Our objects should be: Good carbonizing results, proper control of condensers, effective scrubbing and dry-lime purification, and a small percentage of leakage. We get at these things personally, whereas managers of large works are dependent upon their assistants to some extent for the carrying out of details.

I wish to thank you, gentlemen, for the patient hearing you have given me, and trust that a good discussion may follow my remarks.

Discussion.

Mr. J. M'Laren (Duns) remarked that, as regarded small works, the Directors of many of them would not allow the Manager to do a great deal of what he would like to do. He begged to propose a hearty vote of thanks to the President for his address.

Mr. G. Taylor (Jedburgh) corroborated Mr. M'Laren's remarks. It was difficult, in small works, to get many things done, for want of money. In large ones, money was often scarcely considered; but in small undertakings the Manager had to tell what the cost of anything would be, and he must be sure that he was right.

Mr. Vass said he must express his appreciation of the address; but he thought that many of the points touched on were not so much questions of expenditure as they appeared to have heard them. The introduction of regenerative heating was a matter of pounds, shillings, and pence; and he thought the President had brought out very well the point that it was not long paying for itself, even in small works. As to washing, he thought that the suggestion of the President was not one which would entail a great deal of expenditure, because, if gravity could be brought into play, a little piping would not cost much, and they would have a very valuable purifying agent. But when he used the method suggested, he must always have clean water running in at the back, and that supply was better to be constant. It was sometimes difficult to get a constant supply of clean water going in in such small quantity as would not make the liquor too weak. If a constant service could not be obtained, the next best thing to do was to put in an intermittent supply of water, as small as they could get it. He thought the President had brought out splendid results, both in the make and sale of gas.

Mr. W. Blair (Helensburgh) said he had listened to the address with very great pleasure; and he had to thank the President for it. The results he brought out were very much what he himself had been obtaining in practice during the last sixteen or eighteen years, which was about the time he had been experimenting with regenerative and semi-regenerative systems. A manager of small works had to look to the initial expenses—to pay them out of his own pocket, if he were an enthusiast—and it took him some time before he could experiment with success. He himself hammered away at the matter; and he was glad to say that he had been successful. When he went to Haddington, the make of gas per ton of coal was about 8000 cubic feet; and, using the same size of retorts, he was afterwards able to turn out from 10,600 to 10,700 cubic feet per ton. The quantity of gas produced per lineal foot of retort, with a 20-inch retort, averaged 1033 cubic feet; so that, as had been proved before, regenerative or semi-regenerative systems could be used in the smallest possible works, and they could be operated at a trifling expense. Such a system really repaid itself in the lifetime of the retort. In regard to self-purification, as he might call it, he had, in nearly all his days of gas making, adopted the principle of utilizing hydraulic liquor as a purifying agent, by allowing the liquor to gravitate from the hydraulic main back to the washer; and it answered the double purpose of strengthening the liquor and picking up impurities in the gas. Besides this, it kept the condenser clean. He had worked condensers for eight or nine years, and had never required to draw a bolt in them. In a works where the gas was often below freezing-point, they would know what this meant. About two years ago, he adopted a rotary scrubber in Haddington. He obtained from 54 to 67 gallons of tar and liquor per ton of coal, with an average strength of liquor of from 5½° to 6° Twaddel, so that possibly everything was absorbed which water could absorb; and the process was automatic in its working. He did not think that even in the larger works they were doing better than he did; and a great many of them were not getting anything approaching to his results. In regard to unaccounted-for gas, he was of opinion that variations of temperature were not sufficiently taken into account. He maintained that all meters should be periodically tested—say, every four or five years. He would even go the length of advocating the supply of meters free, and the supervising of the service-pipes to the burner, or at least to the outlet of the meter, so that the manager might have full control of the gas supply to that point.

Mr. H. Rutherford said he concurred in what had been expressed regarding the President's address. They all knew that in small gas-works it was often very uphill work. They had many things to attend to which managers in large works, he believed, knew nothing about; but he thought that, if they put their shoulder to it, they could overcome many difficulties.

Mr. W. M'Giffen (Earlston) said that during the time he had been in Earlston the consumption of gas had risen from 400,000 to 1,621,000 cubic feet, and the price had been reduced from 8s. 4d. to 6s. 10d. per 1000 cubic feet. They paid a dividend of about 10 per cent., and had effected many improvements. There was a great deal of room for improvement; but it was very uphill work. He had adopted the method of taking liquor from the hydraulic main straight to the washer; and by doing so he had reduced the cost of purification by about one-half.

Mr. A. C. Young said he was especially struck with the President's remarks on the subject of regeneration. The regenerative furnace should be in every works, even the smallest. A difficulty which he had always felt, in the case of small works, was that this special system of firing had been patented by several engineers; and managers of small works had a fear that if they attempted anything of their own they would not succeed. And to go in for any of the patents was out of the question, on account of the expense. He thought, however, that everyone should have the regenerative system. The special saving was not so much on the yield per ton (because this could be got from ordinary shallow furnaces) as in the quality of the coke. They could use shale, or almost any sort of coke, in the furnaces; and they could fill up the furnace at night, and find it ready to start in the morning—thus doing away with damping down. This led to the saving of the retorts, because, as they knew, the letting down and getting up of the heat knocked the retorts to pieces. As to leakage, there was a point which, he thought, was apt to be lost sight of—namely, the high pressure that was required to be kept up during the day for gas-cookers. In many works there was not a governor; and the full pressure was on the works night and day. The loss by leakage was in this case enormous.

Mr. M'Giffen mentioned that he had a gas consumer who had seventeen burners, a gas-cooker, and a gas-stove, and only a ½-inch pipe supplying them. He could not get this consumer to allow a bigger pipe to be put in, as he insisted that it was the pressure at the works which was at fault.

This closed the discussion on the President's address.

Mr. Vass introduced the subject of the standardizing of meter-unions, which, he said, had been rather dropped by the North British Association, but which, he thought, they should not drop; and he proposed that they should continue the Committee they had on the subject.

Mr. W. Blair thought they had the matter in their own hands, as, if they ordered meters of a uniform standard, they would get them.

Mr. D. M. Nelson (Glasgow) supported Mr. Blair's views.

Mr. Vass's motion was agreed to.

Mr. Vass asked the opinion of the members upon the subject of stove-hires. At present the customary charge was 10 per cent. per annum. There was this difficulty—that as new stoves came out, hirers were apt to return the stoves they had, and to ask for the later ones. It had been suggested that, to obviate this, the hire should be reduced after five years.

Mr. M'Laren said that his consumers preferred to purchase stoves outright.

The President thought that if a consumer hired a stove for ten years, he should get the stove as a present, as it would have yielded a sufficient return in the amount of the hire and the revenue from gas consumed.

Mr. A. C. Young said he favoured the supplying of cookers free, so as to encourage the consumption of gas.

The President thought this would be creating a differential rate, to the prejudice of the ordinary consumer.

The meeting was then closed.

The members and friends, including ladies, dined together in the Station Hotel. The toast of "The Waverley Association" was given by Mr. A. Gillespie, of Glasgow; and that of "Kindred Associations," by the President, and responded to by Mr. D. M. Nelson. In responding to the toast of his own health, the President said that the Waverley was the most friendly of all Associations. It had existed in amity for nearly forty years without a rule or a bye-law. Afterwards the party visited Melrose Abbey, under the guidance of Mr. W. Smith.

PACIFIC COAST GAS ASSOCIATION.

Annual Meeting in San Francisco.

This Meeting was opened by the President, Mr. C. F. Adams, of Portland, Oregon, on the 18th ult., and continued on the following day. Seven new members were admitted; and the Secretary (Mr. J. A. Britton) was elected Vice-President for the ensuing year; the duties of his present office being undertaken by Mr. Grimwood.

Mr. John L. Howard read a paper on "The Fuel Question in California." He remarked that, although veins of coal extended throughout the western length, the State drew a greater variety of coal from more varied sources than any other country on the face of the globe. At times she had paid as much as 90 per cent. of the duty on the importation of coal to the United States. The importations for the year 1898 included 651,000 tons from British Columbia, 202,000 tons from Australia, 80,000 tons from Great Britain, and 842,500 tons from other American States. The native coal was a lignite, heavily charged with sulphur and ash, which had a low calorific value, and disintegrated rapidly on exposure. In the lower half of the State, the seams were not workable; but mining operations had been conducted in the central district for forty years. For a long period the output reached 150,000 tons per annum; but it had lately dwindled. The demand for coal was practically restricted to half-a-dozen principal towns; wood being cheap and plentiful throughout the rest of the district, and quite capable of serving the needs of a sparse population. When California began to produce wheat and export it to Britain, the ships found it profitable to bring back coal; and of the 800,000 tons of wheat produced per annum, one-half was carried away by ships which brought coal on the return voyage. While the free-on-board cost of British coal was fairly constant, the freightage rates varied from 8s. to 19s., according to the conditions and prospects of the wheat market. High wheat freights meant cheap coal. But speculative business was now almost replaced by fixed contract rates. On account of continual labour troubles in Great Britain, and the uncertain rates, the trade with that country was gradually diminishing; being replaced by supplies from the Northern States, which were reliable, and could be delivered in four days. These would further reduce, if not entirely exclude, the trade in British coal. The effects of the competition of gas as a fuel, of the use of petroleum for a similar purpose, and of electricity generated by water power, upon the coal trade were next considered. The coal producer would find himself compelled to make a reduction in price, to enable him to retain a share of the business, some of which would certainly go to the three active agents above named. The American coal producer could afford to ignore British competition; but these local conditions were not so easily reckoned with. In concluding, the author expressed the opinion that an isthmus canal would not be of much benefit to the Californian coal trade.

The paper elicited an animated discussion, which turned almost entirely upon local conditions. A large increase in the use of fuel gas was reported, as well as of water-power electricity. It was stated that a big anthracite field had been discovered in China, and was being developed on an extensive scale. South Mexican anthracite was claimed to be of as good quality as Welsh.

A paper entitled "Electrolytic Trials" was read by Mr. W. A. Aldrich, of Spokane. He explained at some length the causes and the effects of electrolysis; following this up by practical examples of injury to gas and water pipes caused by stray currents from electric trolley-lines. The rails were used for the negative or return current; and as no special effort was made to insulate them, a portion of the negative current made its way through the earth, and followed any line of low electrical resistance. He said experiments had shown that one ampère flowing steadily from an iron surface would corrode and oxidize nearly 20 lbs. of metal in a year. Some tests conducted at Spokane showed that several of the gas-mains were decidedly positive to the trolley-rails; the strength of the current frequently reaching 30 or 40 volts. Others were negative to a like extent.*

Discussion being invited, Mr. Gregory said that at San Jose the gas-pipes had escaped, but the water-pipes had suffered. The soil was dry; and the presence of moisture was essential to electrolytic action. The water company had protected their services by sheathing them in old disused pipe of a larger size. In one moist place, he had found a gas-pipe perforated; and he held that electrolysis was no phantom, but a real danger. Mr. Jones pointed out that every pennyworth of oxide formed by electrolysis cost the electric company 4s. or 5s. Mr. Aldrich, in replying, said that all classes of metal—steel, wrought iron, or cast iron—were equally affected. The single-line system was the cause of all the trouble; and the adoption of the double line would save the electric companies 40 per cent., and prove a cure for electrolysis.

A paper on "The Automatic Ignition of Gas by Chemical Means" was read by Mr. J. B. Grimwood, of San Francisco. He commenced with a historical notice of the subject; referring to the experiments of Edmund Davy, Liebig, Döbereiner, and others. As regarded the ignition of coal gas, Max Rosenfeld discovered in 1888 that platinum black would not do this by itself, but that a metallic platinum wire must be combined with it, and that the wire must extend across the boundary or outside of the flame. It was soon found that the igniter, if left in position, deteriorated by deposition of carbon and by the heat of the flame; so various expedients for removing it out of the way were tried. But the best form of igniter was that in which the platinum ignited a pilot, which in its turn lit up the main burner and was at the same time extinguished. A specimen of this class was exhibited, and explained in detail. Some self-lighting mantles, having the igniting material incorporated in their substance, were also exhibited. As the active principle in the gas was hydrogen, gases that were poor in respect to this constituent would not operate the self-igniter. The action was not entirely confined to the free hydrogen, as some of the hydrocarbons also produced it. But in order to do so, they must be decomposed with deposition of carbon, which was objectionable. He also understood that the self-igniter was not a great success with street lighting, which was probably due to accumulations of dust on the platinum pill.

Mr. G. H. Hollidge, the Editor of the "Wrinkle" Department, said that although he had a larger collection than last year, many of his items came from outside sources; and he invited the members to excercise more energy in forwarding contributions to this department. As usual, the devices were mostly of a home-made character, and as such exhibited very considerable ingenuity. Mr. W. B. Cline sent an illustrated description of a small steam-injector for introducing air at the inlet of the exhauster. This gentleman also furnished particulars of a registering pressure-gauge. Mr. A. L. Rice, of Riverside, sent a description of a cheap oil-heater for water-gas plant, very much on the lines of an ordinary waste-steam superheater. A main cock, with side outlet, to admit of blowing out naphthalene without disconnecting, was also described. Mr. W. M. Parker, of Bellingham, described a self-acting drip for use in districts where the mains were below high-water mark. It consisted of a deep U-pipe, with an ordinary lever ball cock on the outlet, contained in a box with a perforated bottom. At high tide, the water rose in the box, and closed the cock by means of the float. As the tide fell, the level of the water fell also; allowing the cock to open, when any water contained in the mains would flow out and escape through the bottom of the box. This device was smartly criticized; Mr. Collins objecting to any form of automatic drip as carrying an element of danger with it. Mr. John J. M'Kenna sent a description of a substitute for bladders or bags for temporarily stopping mains, consisting of an arrangement of springs covered with leather, which could be put through an ordinary service-hole, and expanded to a disc-like form, completely filling the main. Mr. J. R. Thompson, of Colusa, exhibited a very ingenious piece of machinery, devised and constructed by himself, for use in connection with water-gas plant, to indicate the time of each run and the quantity of gas made as shown by the rise of the holder. A description of a hit-and-miss device for regulating the supply of air to bunsen burners led to a discussion as to the effect of too much or too little air as regards economical results. Mr. Lowe said the best results were obtained when the flame just showed a faint yellow tip; and the flame should be so adjusted as not to touch the utensils.

A paper on "Artificial Illumination" was read by Mr. L. P. Lowe, who limited his consideration to ordinary gas, acetylene, and incandescent electric light. Ordinary gas was usually sent out of about 20-candle power; but the introduction of the incandescent light had greatly increased its effectiveness. A burner using 2½ cubic feet of gas per hour would yield 60 candles; representing a cost, light for light, of one-sixth that of the ordinary burner. An incandescent electric lamp used 3·6 watts per candle-hour, or 57·6 watts for a 16-candle lamp. Acetylene in practice gave a 20-candle light with a consumption of 0·5 cubic feet per hour; and the cost of carbide might be taken at 3½d. per pound. Gas ranged from 4s. to 10s. per 1000 feet in price; and electricity from 5d. to 10d. per unit—usually being over 7d. From these data, the author had prepared tables showing cost per hour, and candle-hours obtained for 4s. 2d.

The meeting closed with the usual votes of thanks. On the following day, a pleasure excursion was taken; and in the course of the proceedings, Mr. Britton was presented by the members with a handsome silver loving cup, as a recognition of his services for seven years as Secretary.

* It will be seen by our "Legal Intelligence" that the Spokane Gas Company have obtained an injunction against the offending Railway Company.—Ed. J. G. L.

THE CHLORIDE OF LIME PROCESS FOR THE PURIFICATION OF ACETYLENE.

Herr F. B. Ahrens, in a recent number of the "Zeitschrift für angewandte Chemie," discusses the chloride of lime process for purifying acetylene. He points out that acetylene obtained from calcium carbide and water contains on an average 0·5 per cent. of impurities, of which certain sulphur and phosphorus compounds are the most obnoxious. To remove these compounds is the problem which is presented in the proper purification of acetylene.

Of the purifying agents which have been proposed, two—viz., Frank's solution of cuprous chloride in hydrochloric acid, and Ullmann's acid solution of chromic acid, either of which may be

absorbed by kieselguhr, and thus applied in the solid form—have fulfilled their object in a reasonably adequate manner, but have not actually effected the quantitative removal of the impurities named. Chloride of lime, which was applied before either of these agents, alone removes phosphuretted hydrogen and organic sulphur and phosphorus compounds completely from commercial acetylene. Therefore it has been freely used in conjunction with the acidified solution of calcium chloride, and ferric hydrate, for the purification of acetylene; but unfortunately it exhibits some objectionable minor reactions. It gives rise to carbonic oxide and chlorinated compounds. Crude acetylene, which is free from carbonic oxide, if passed through chloride of lime, and thence into a solution of blood, causes the latter to exhibit clearly the carbonic oxide spectrum. The quantity of carbonic oxide formed, however, is but small; and the application of chloride of lime would not be precluded on account of this action. But if the acetylene which has been passed through chloride of lime is consumed in a solution of potassium permanganate, a large quantity of chlorine will be found in the colourless filtrate. The amount will be much diminished if the gas be passed through lime after it leaves the chloride of lime. But gas purified by chloride of lime always retains organic compounds of chlorine, which would destroy or choke burners made of other material than steatite. In many cases, moreover, the acetylene thus purified has been found to have an intolerable odour of chlorine; and the lighting of the town of Vesprcem, for example, had to be temporarily suspended on account of the smell of chlorine in the houses. Another cause of interruption of working, also, is the sudden and intense heating up of chloride of lime purifiers, resulting in the material being soon rendered inactive.

Herr Ahrens considered that the reasons of the aforementioned objectionable behaviour of chloride of lime as a purifying agent might be ascertained by investigation. He thought the heating might arise from a reaction between acetylene and chloride of lime, induced by a high proportion of active chlorine in the latter; but no heating ensued when he passed acetylene for a long time over the best chloride of lime. Even when the chloride of lime was maintained at a temperature of nearly 212° C., there was no sudden or violent reaction, although evidently a consumption of acetylene took place. He next, therefore, took the material as it would ordinarily be used in practice—viz., fresh strong chloride of lime mixed with sawdust and moistened. The proportions of the several components of this mixture varied frequently; and it appeared that, with a certain quantity of water, heating occurred, and even a temperature of 266° Fahr. was observed. This heating did not occur immediately after mixing, but after the lapse of a certain time, which was dependent on the proportions of the components of the mixture. It was attended by an exhalation of steam and chlorine. Both the heating effects and the odour of chlorine arise from the same cause; and the acetylene itself is not responsible for them. The complaint that chloride of lime is not of high purifying power is also to be traced to the same origin; and Herr Ahrens states that he has repeatedly satisfied himself that this material has really a very high efficiency as a purifying agent. He gives a table of the results of observations which he had made on the rise of temperature when chloride of lime of 34 per cent. strength, sawdust, and water were mixed in various proportions. Some of the more striking results are given in the appended abridgement of his table.

Grammes of			Maximum Temperature attained.	Time in which the Maximum Temperature was attained.
Chloride of Lime.	Sawdust.	Water.	Degrees Fahr.	Minutes.
30	20	5	113	10
30	20	10	156	50
30	20	15	248	4
20	20	10	257	17
20	20	15	253	5
20	10	9	266	7
20	5	5	99	—
20	5	10	120	10
20	5	12	257	4
7·5	20	10	160	7
7·5	20	20	174	2

In order to obtain direct evidence that the heating effects observed were due to a reaction between the hypochlorite (chloride of lime) and sawdust, a clear cold solution of chloride of lime was mixed with sawdust; and in a short time a temperature of 203° Fahr. ensued. Parallel experiments made with finely divided pure cellulose, in place of the sawdust, did not show any remarkable rise of temperature. It must therefore be the lignin of the sawdust which reacts with the hypochlorite, and develops the great heat.

Herr Ahrens considers his researches prove that chloride of lime should, in order that objectionable reactions may be guarded against, be used mixed with much sawdust or with very little water; or that for choice the sawdust should be entirely dispensed with, and kieselguhr, coke dust, brick dust, lead chromate, or other material, be used in its place, to give a sufficient degree of porosity to the chloride of lime.

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

The Annual Meeting of the above-named Association opened in Dover last Wednesday, under the presidency of Sir MICHAEL FOSTER. The preliminary meeting of the General Committee was held in the afternoon, when the annual report of the Council was submitted and approved. In the course thereof they deplored the loss the Association had sustained by the death of Sir Douglas Galton, who for 24 years occupied the responsible position of General Secretary—a post which he resigned only on becoming President in 1895; and they placed on record their sense of the invaluable services rendered by him. The General Treasurer (Professor Carey Foster) presented his account for the year, which showed a balance of £1549, as compared with £1704 at the close of the previous year. Professor Rücker moved a vote of thanks to the retiring President (Sir William Crookes); remarking that, while presidential addresses were often valuable contributions to the literature of science, it was seldom that one of them held the public interest and attention so closely and so long as that delivered last year. The motion was carried by acclamation.

In the evening, the President delivered his Inaugural Address. After paying a tribute to the memory of the late Sir Douglas Galton, he glanced over the events of the past hundred years, noting the changes which have been effected during that period in the external conditions of life, and directing attention to the share which discovery and progress in physical science have had in bringing about those changes. He dwelt first on the significance and consequences of the discovery of oxygen; his remarks on this subject being as follows: In the philosophy of the ancients, earth, fire, air, and water were called "the elements." It was thought, and rightly thought, that a knowledge of them and of their attributes was a necessary basis of a knowledge of the ways of Nature. Translated into modern language, a knowledge of these "elements" of old means a knowledge of the composition of the atmosphere, of water, and of all the other things which we call matter, as well as a knowledge of the general properties of gases, liquids, and solids, and of the nature and effects of combustion. Of all these things our knowledge to-day is large and exact and, though ever enlarging, in some respects complete. When did that knowledge begin to become exact? To-day the children in our schools know that the air which wraps round the globe is not a single thing, but is made up of two things—oxygen and nitrogen (some may already know that there is at least a third thing, argon)—mingled together. They know, again, that water is not a single thing, but the product of two things—oxygen and hydrogen—joined together. They know that when the air makes the fire burn and gives the animal life, it is the oxygen in it which does the work. They know that all round them things are undergoing that union with oxygen which we call oxidation, and that oxidation is the ordinary source of light and heat. Let me ask you to picture to yourselves what confusion there would be to-morrow, not only in the discussions at the sectional meetings of our Association, but in the world at large, if it should happen that in the coming night some destroying touch should wither up certain tender structures in all our brains, and wipe out from our memories all traces of the ideas which cluster in our minds around the verbal tokens, oxygen and oxidation. How could any of us—not the so-called man of science alone, but even the man of business and the man of pleasure—go about his ways lacking those ideas? Yet those ideas were in 1799 lacking to all but a few. Although in the third quarter of the seventeenth century the light of truth about oxidation and combustion had flashed out in the writings of John Mayow, it came as a flash only, and died away as soon as it had come. For the rest of that century, and for the greater part of the next, philosophers stumbled about in darkness, misled for the most of the time by the phantom conception which they called *phlogiston*. It was not until the end of the third quarter of the eighteenth century that the new light, which has burned steadily ever since, lit up the minds of the men of science. The light came at nearly the same time from England and from France. Rounding off the sharp corners of controversy, and joining, as we may fitly do to-day, the two countries as twin bearers of a common crown, we may say that we owe the truth to Cavendish, to Lavoisier, and Priestley. If it was Priestley who was the first to demonstrate the existence of what we now call oxygen, it is to Lavoisier that we owe the true conception of the nature of oxidation, and the clear exposition of the full meaning of Priestley's discovery; while the knowledge of the composition of water, the necessary complement of the knowledge of oxygen, came to us through Cavendish, and, we may perhaps add, through Watt. The date of Priestley's discovery of oxygen is 1774. Lavoisier's classic memoir "On the Nature of the Principle which Enters into Combination with Metals during Calcination" appeared in 1775, and Cavendish's paper on the composition of water did not see the light until 1784. During the last quarter of the eighteenth century, this new idea of oxygen and oxidation was struggling into existence. How new was the idea is illustrated by the fact that Lavoisier himself at first spoke of that which he was afterwards (in 1778) led to call "oxygen"—the name by which it has since been known—as "the principle which enters into

combination." What difficulties its acceptance met with is shown by the fact that Priestley himself refused to the end of his life to grasp the true bearings of the discovery which he had made. In the year 1799, the knowledge of oxygen, of the nature of water and of air, and, indeed, the true conception of chemical composition and chemical change, was hardly more than beginning to be; and the century had to pass wholly away before the next great chemical idea, which we know by the name of the atomic theory of John Dalton, was made known. We have only to read the scientific literature of the time to recognize that a truth which is now not only woven as a master-thread into all our scientific conceptions, but even enters largely into the every-day talk and thoughts of educated people, was a hundred years ago struggling into existence among the philosophers themselves. It was all but absolutely unknown to the large world outside those select few.

From the discovery of oxygen the President passed on to refer to the birth of electricity. On this subject he said: If there be one word of science which is writ large on the life of the present time, it is the word "electricity." It is, I take it, writ larger than any other word. The knowledge which it denotes has carried its practical results far and wide into our daily life, while the theoretical conceptions which it signifies pierce deep into the nature of things. We are to-day proud, and justly proud, both of the material triumphs and of the intellectual gains which it has brought us, and we are full of even larger hopes of it in the future. At what time did this bright child of the nineteenth century have its birth? He who listened to the small group of philosophers of Dover, who in 1799 might have discoursed of natural knowledge, would perhaps have heard much of electric machines, of electric sparks, of the electric fluid, and even of positive and negative electricity; for frictional electricity had long been known, and even carefully studied. Probably one or more of the group, dwelling on the observations which Galvani, an Italian, had made known some twenty years before, developed views on the connection of electricity with the phenomena of living bodies. Possibly one of them was exciting the rest by telling how he had just heard that a Professor at Pavia—one Volta—had discovered that electricity could be produced not only by rubbing together particular bodies, but by the simple contact of two metals, and had thereby explained Galvani's remarkable results. For, indeed, it was in that very year, 1799, that electricity as we now know it took its birth. It was then that Volta brought to light the apparently simple truths out of which so much has sprung. The world, it is true, had to wait for some twenty years before both the practical and the theoretic worth of Volta's discovery became truly pregnant, under the fertilizing influence of another discovery. The loadstone and magnetic virtues had, like the electrifying power of rubbed amber, long been an old story; but, save for the compass, not much had come from it. And even Volta's discovery might have long remained relatively barren had it been left to itself. When, however, in 1819, Oersted made known his remarkable observations on the relations of electricity to magnetism, he made the contact which was needed for the flow of a new current of ideas. And it is, perhaps, not too much to say that those ideas, developing during the years of the rest of the century with an ever-accelerating swiftness, have wholly changed man's material relations to the circumstances of life, and at the same time carried him far in his knowledge of the nature of things.

Dealing next with the evolution of geological science, the President pointed out that in 1799 this science, as we now know it, was struggling into birth. There had been from of old cosmogonies—theories as to how the world had taken shape out of primeval chaos. In the fresh spirit which marked the zealous search after natural knowledge pursued in the middle and latter part of the seventeenth century, the brilliant Stenson, in Italy, and Hooke, in this country, laid hold of some of the problems presented by fossil remains; and Woodward, with others, had laboured in the same field. In the eighteenth century, especially in its latter half, men's minds were busy about the physical agencies determining or modifying the features of the earth's crust. The way was being prepared, theories and views were abundant, and many sound observations had been made; and yet the science of geology, properly so called—the exact and proved knowledge of the successive phases of the world's life—might be said to date from the closing years of the eighteenth century. In 1783, James Hutton put forward in a brief memoir his "Theory of the Earth," which in 1795—two years before his death—he expanded into a book. But his ideas failed to lay hold of men's minds until the century had passed away, when, in 1802, they found an able expositor in John Playfair. The very year in which Hutton published his theory, Cuvier came to Paris and almost forthwith began, with Brongniart, his immortal researches into the fossils of the city and its neighbourhood. And four years later—viz., in the year 1799 itself—William Smith's tabular list of strata and fossils saw the light. He (the President) believed it was not too much to say that out of these geology, as now known, sprang. It was thus in the closing years of the eighteenth century that was begun the work which the nineteenth century had carried forward to such great results. But at that time only the select few had grasped the truth, and even they only the beginning of it. Outside a narrow circle, the thoughts, even of the educated, about the history of the globe were bounded by the story of the deluge—though the story was often told in a strange fashion—or were guided by fantastic views of the plastic forces of a sportive Nature.

Coming to biological science, the President showed how different were the thoughts of men on the problems presented by living things in 1799 from those of the men of to-day. He cited Sir Charles Bell's enunciation of his theory of the nervous system and Darwin's "Origin of Species" as among the most important contributions to this science; and he showed how great a gulf lay between 1799 and 1899, with respect to natural knowledge. That gulf, he said, was a twofold one. Not only had natural knowledge been increased, but men had run to and fro, spreading it as they went. The span between the science of 1799 and that of to-day represented, beyond all question, a great stride onwards. The story of science in the nineteenth century was one of continued progress. There was no falling back—no standing still. What was gained by scientific inquiry was gained for ever. It might be added to; it might seem to be covered up; but it could never be taken away. The President went on to show that not only has mankind gained material good through the advance of science, but he has derived intellectual benefit, inasmuch as it demands from its follower exactitude and care in investigation, alertness of mind, and moral courage—not so much the courage which helps a man to face a sudden difficulty, as that of steadfast endurance. It might be said that these qualities were not the peculiar attributes of the man of science; they might be recognized as belonging to almost everyone who had commanded or deserved success, whatever might have been his walk in life. This was so. This was exactly what he would desire to insist upon—that men of science had no peculiar virtues, no special powers. They were ordinary men; their characters were common, even commonplace. Science, as Huxley has said, was "organized common sense;" and men of science were common men, drilled in the ways of common sense. But their lives had this feature—they possessed a strength which was not their own, but that of the science whose servants they were. Speaking further on this topic, the President said: The pursuit of science must be followed, not by the professional few only, but, at least in such measure as will ensure the influence of example, by the many. . . . The training to be looked for from science is the outcome, not of the accumulation of scientific knowledge, but of the practice of scientific inquiry. Man may have at his fingers' ends all the accomplished results and all the current opinions of any one or of all the branches of science, and yet remain wholly unscientific in mind; but no one can have carried out even the humblest research without the spirit of science in some measure resting upon him. And that spirit may in part be caught even without entering upon an actual investigation in search of a new truth. The learner may be led to old truths—even the oldest—in more ways than one. He may be brought abruptly to a truth in its finished form, coming straight to it like a thief climbing over the wall; and the hurry and press of modern life tempt many to adopt this quicker way. Or he may be more slowly guided along the path by which the truth was reached by him who first laid hold of it. It is by this latter way of learning the truth, and by this alone, that the learner may hope to catch something at least of the spirit of the scientific inquirer.

Other subjects dwelt upon by the President were science in its relation to politics and international brotherhood. He pointed out that the man of science cannot sit by himself in his own cave, weaving out results by his own efforts, unaided by others, heedless of what others have done and are doing. He is but a bit of a great system, a joint in a great machine; and he can only work aright when he is in due touch with his fellow-workers. If his labour is to be what it should be, and is to have the weight which it ought to have, he must know what is being done, not by himself, but by others, and by others not of his own land and speaking his tongue only, but also of other lands and of other speech. Hence it comes about that to the man of science the barriers of manners and of speech which pen men into nations become more and more unreal and indistinct. He recognizes his fellow-worker, wherever he may live and whatever tongue he may speak, as one who is pushing forward shoulder to shoulder with him towards a common goal, as one whom he is helping, and who is helping him. "The touch of Science," said the President, "makes the whole world kin." He referred to the proposed Witenagemote to be held next year in Paris, at which the learned academies of the world will be represented, as not the least notable fact of international co-operation in science.

In bringing his address to a close, the President said: Looking back, in this last year of the eighteen hundreds, on the century which is drawing to its close, while we may see in the history of scientific inquiry much which, telling the man of science of his shortcomings and his weakness, bids him be humble, we also see much perhaps more which gives him hope. Hope is, indeed, one of the watchwords of science. In the latter-day writings of some who know not science, much may be read which shows that the writer is losing or has lost hope in the future of mankind. There are not a few of these; their repeated utterances make a sign of the times. Seeing in matters lying outside science few marks of progress and many tokens of decline or of decay, recognizing in science its material benefits only, such men have thoughts of despair when they look forward to the times to come. But if there be any truth in what I have attempted to urge to-night—if the intellectual, if the moral

influences of Science are no less marked than her material benefits, if, moreover, that which she has done is but the earnest of that which she shall do—such men may pluck up courage, and gain strength by laying hold of her garment. We men of science at least need not share their views or their fears. Our feet are set, not on the shifting sands of the opinions and of the fancies of the day, but on a solid foundation of verified truth, which by the labours of each succeeding age is made broader and more firm. To us the past is a thing to look back upon, not with regret, not as something which has been lost never to be regained, but with content, as something whose influence is with us still, helping us on our further way.

DR. PERCY FRANKLAND ON THE WATER-GAS REPORT.

In the notice which appeared in our editorial columns on the 5th inst. of the address delivered by Dr. PERCY FRANKLAND, F.R.S., as President of the Section of Physics, Chemistry, and Biology, at the recent congress of the Sanitary Institute at Southampton, we mentioned that it consisted to a large extent of a running commentary on the contents of the Blue-books specially relating to sanitary science issued in the past year. One of these was the report of the Departmental Committee on Water Gas, respecting which Dr. Frankland remarked that the inquiry of which it gave the results, was in reference to a conflict between the interests of the gas manufacturer and the safety of the general public, and was therefore of the widest interest. He then went on to say that the investigation had been provoked by the introduction of modifications in the process of gas manufacture leading to the circulation in many of our towns of an illuminating gas appreciably richer than ordinary gas in carbonic oxide, which, as was well known, was the most poisonous constituent of that gas. The inquiry was in some respects a remarkable one; for it was admitted on all hands that the actual risk to the individual by this increased proportion of carbonic oxide was almost infinitesimal, and it might therefore, at first sight, be thought hardly worth while to make this a subject of elaborate investigation. He believed, however, he was right in thinking there was something fundamentally repugnant to an Englishman in the idea that a life should be unnecessarily sacrificed.

The danger involved by the admixture of water gas with ordinary coal gas was investigated by a particularly competent Committee, which actually numbered among its members one scientific man—Dr. Haldane, F.R.S.—who had previously devoted his attention to the subject with success. A large amount of interesting information was collected by the Committee, who were to be congratulated on having taken up a strong position in respect to the growing danger to the community entailed by the admixture, beyond certain limits, of water gas with the ordinary household illuminant. It had been conclusively shown by Dr. Haldane that, given equal conditions as to size of room, ventilation, flow of gas, and length of time to which a person was exposed to an escape, the danger to life from such an escape was far greater in the case of gas containing any considerable proportion of water gas than in that of ordinary coal gas. In fact, the really important point to bear in mind was, that the danger increased at a much greater rate than the proportion of carbonic oxide; or, in other words, that a gas containing twice as much carbonic oxide as ordinary coal gas was much more than twice as dangerous as such gas.

In the opinion of the Committee, convincing evidence of the danger attending the distribution of gas rich in carbonic oxide was to be found in the mortality statistics of Massachusetts. These figures showed that in Boston, in 1886, with no water gas, there were no casualties out of 29 554 consumers; whereas in 1890, with 8 per cent. of water gas, there were six deaths with 46,848 consumers. When the percentage was raised to 90 in 1895, there were 24 deaths with 68,214 consumers; and with an increase to 93 per cent. in 1897, there were 45 deaths out of 79,893 consumers. These figures proved that the unrestricted development of the water-gas industry must be viewed with grave apprehension. Fortunately, there was not the same commercial advantage in this country for the substitution of water gas for coal gas to the extent to which this had already taken place in America; and it should therefore be the more easy to control the proportions in which it was distributed. The Committee suggested that the distribution of gas containing more than 20 per cent. of carbonic oxide should be prohibited—a limit which would roughly correspond to a mixture consisting of equal parts of coal gas and carburetted water gas.

The question of the practical danger attending the distribution of carburetted water gas was not a little complicated by the fact that a considerable number of the fatalities to which he had referred as having taken place in Boston were due to suicide, and not to accident. Thus, while this circumstance showed that the danger from accident was less than would be indicated by the total number of deaths, it demonstrated, on the other hand, that a particularly seductive instrument of death was being distributed broadcast among the population. The Legislatures of civilized countries interfered in the matter of the distribution of deadly poisons, solid and liquid. But perhaps it was too much, even at the close of the nineteenth century, to expect our rulers to possess sufficient scientific education to take cognizance of an invisible gas.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

The Hastings Carburation Process.

SIR,—Mr. Botley regrets that, even now, I am unable to admit the facts in regard to the above; that I have not, like others of his critics, visited his works, but have come to conclusions that are mainly based on premises which have no foundation in actual fact; and that therefore he will not trespass upon your space beyond replying briefly, for the information of those of your readers interested, to one or two of my statements.

So far as I am aware, I have never refused to admit Mr. Botley's statements, so long as they could be accepted as facts—that is, so long as they were in harmony with scientific laws and logic; but when they were consistent with neither, I could not admit them. I have all along freely admitted that it was a fact that Mr. Botley's process would prevent naphthalene being deposited. What I have been unable to admit, and what I have questioned, is Mr. Botley's explanation of the scientific principles of how it does succeed, the quantity of oil required to be sprayed into the gas to make it succeed, and to what extent the amount of oil necessary to make the process a success at Hastings is modified by the carburetted water gas; and I have tried to discuss these points on purely scientific lines, and with an earnest desire to assist in developing a sound conception of the principles involved in the solution of the naphthalene problem. Mr. Botley, in his brief reply to the statement made by me, furnishes an excellent example of how he deals with the subject. He says: "I repeat most emphatically that the carburetted water gas has not anything to do with the success of the carburation process which is now in use. . . . It is, of course, true that mixing water gas with coal gas for distribution reduces the total amount of naphthalene which can possibly be deposited. . . . . And in 1898 (last year) the water gas was under 17 per cent. of our total make." Now, it logically follows that the carburetted water gas would lessen the quantity of oil required per 1000 cubic feet to prevent naphthalene being deposited by at least 17 per cent. Mr. Botley, seeing this logical conclusion, says: "But there are contrary influences at work which evidently render the dilution practically of no consequence." What are these influences that are at work? Why does Mr. Botley not explain why the carburetted water gas fails to do at Hastings what it has been found to accomplish elsewhere?

It was unnecessary for me to visit the Hastings works to get the information required to enable me to criticize Mr. Botley's statements regarding the process. The statements themselves supplied what was needed; and Mr. Leather, one of his other critics, who visited his works and examined the process, and to whom he gave samples of the oils before and after use, has supplied the requisite data to prove the soundness of my criticism. Mr. Leather confirms my expressed opinion that the success of the Hastings process is not due to the creation of an artificial vapour tension, as stated by Mr. Botley, but that the process is an oil-scrubbing one carried out in the mains and services, just as I contended. Mr. Leather's analysis of the oils before and after use clearly proves that Mr. Botley's reiterated statement that the oil deposited in the works main did not contain naphthalene was not a fact, but that it not only contained naphthalene in considerable quantities, but also other volatile hydrocarbon illuminants which it had dissolved out of the gas—all confirmatory of my criticism; and the constitution of these hydrocarbons bore evidence that, whatever part the carburetted water gas is now contributing to the prevention of naphthalene deposits, at the time at which the deposited oil was taken from the works mains it was playing an important part.

The conclusion which appears to me should be drawn from the concluding paragraph of Mr. Botley's letter is that it betrays a condition of matters the rectification of which should have Mr. Botley's immediate attention.

Priorsford, Peebles, Sept. 15, 1899. WM. YOUNG.

The Consumption of Water per Head in Different Towns.

SIR,—Among others, I have been interested by the paper, the remarks by "Distributing Engineer," and the subsequent correspondence on the above subject. No statistics as to the consumption of water per head per day are of any material value for general use; local circumstances and industries varying so greatly. The only item which one can be certain of is the real quantity of liquid required by each person. This, according to eminent authorities (although, of course, varying with the age and occupation of the consumer), is from 4 to 5 pints per day. The quantity used per head for necessary household purposes, such as for cooking, personal ablution, and washing clothes, never exceeds 8 gallons per day. Outside purposes may increase this to 16 or 18 gallons; but, after this, all is uncertain—the class of town and the industry of its population being the only means observable to account for the difference between 18 and 50 gallons per head per day. Rural districts—invariably without industry—show, as a rule, a total consumption of about 15 gallons per head per day.

Although digressing from the subject under discussion, perhaps I may be allowed to correct "Student" in one or two of his assertions made in the "JOURNAL" for the 29th ult. There may be still a few towns where the introduction of the intercepting chamber has not yet come into vogue. But the number is rapidly diminishing; and with this decrease the waste of water must necessarily decrease also. A complete system of private drainage, on the lines laid down by the "Model Bye-Laws" of the Local Government Board, is easily cleared, should a stoppage take place, by drain-rods. In the old system of drainage, flushing was invariably resorted to; and great waste of water thus ensued. When a gulley on a house-drain becomes unsealed, the air from the main sewer is still unable to get into the house—the trap in the intercepting chamber preventing it. Only the gas generated in the private drain escapes into the air. I am afraid the experience of the householder that a ½-inch tap will cause the sewer gas to change its natural course is somewhat peculiar. The inlet of air being governed by a "mica flap," with an outlet in the form of a 4 or 6 inch shaft carried up above the eaves, the velocity of air travelling through the drain is never counteracted by the flow of water.

As the result of experiments I have myself made, under similar circumstances, I have found velocities of air of 40 feet per minute issuing from the vent-shaft. Surely a drainage system as set out in the "Model Bye-Laws" of the Local Government Board would not be upset by the discharge of a ½-inch tap.

An occasional house-to-house inspection will certainly prove of much material value to a water company; but the chief detection of waste must be made in the public highway, either by means of meters, such as the Venturi, on the larger mains, or by sounding stopcocks on the services, and, in addition, the usual employment of a night inspector.

Sept. 13, 1899. ASSISTANT.

SIR,—"A Distributing Engineer," writing in the "JOURNAL" on the 8th ult., opened up a good opportunity for the discussion by water-works managers of several questions which may be termed of vital importance to them as a body. We heard much during the recent severe drought about the consumption of water per head per day; but, as "Distributing Engineer" points out, the statement has no meaning of any value to engineers, because of the unsatisfactory manner in which the statistics bearing thereon are collected. In order to be of any use for comparison, the lowest as well as the highest consumption during the year should be given; also, where the consumption is very low or abnormally high, some remarks as to the cause would be of use. The rate per head should be on the total quantity of water pumped for all purposes.

We have recently read of the consumption of 21 gallons per head at Tunbridge Wells being set up as a paragon of perfection against Epsom's 55 gallons per head; and yet I observe that in June last the Grand Junction Water Company are reported to have supplied 54·47 gallons per head, followed by the Chelsea Company with 51 gallons. Many more towns could be quoted which during this summer are reported to have supplied upwards of 55 gallons per head to the consumers.

The drought of the present year has put clearly before the authorities the necessity for prompt action towards reducing the extra demand which takes place during the hot and dry months of summer in suburban districts where the gardens are freely watered from the hose-pipe. Croydon this year has compelled its consumers to take all garden supplies by meter; the charge formerly made furnishing an insufficient return for the quantity of water used. Sutton finds the strain more than it can bear, and has threatened to make the price of water for garden supplies prohibitive unless consumers are more moderate. The same remark applies to Epsom. Experience points to the fact that a water-supply undertaking carried on by a company under a Special Act is the one which will compare to the best advantage. The manager has to satisfy his Directors, whose sole interest is the welfare of the company. This argument cannot be advanced where the supply is controlled by a municipal authority, the members of which are always anxious to keep down the rate, and are frequently disposed to adopt a cheese-paring policy, and defer making necessary improvements, until they are suddenly awakened to the fact that their water supply is not as it should be, and compares unfavourably with other towns which have advanced with the times.

No town should be without its systematic method of dealing with waste, and its standard of fittings or sound bye-laws and regulations, with heavy penalties for breaking them; and yet it is surprising to find how apathetic many towns are, even now, on this subject.

Sept. 16, 1899. ANOTHER DISTRIBUTING ENGINEER.

The Lighting of San Paulo.

SIR,—A Company having been formed in the United States, called the S. Paulo Street Railway, Light, and Power Company, Limited, with a capital equal in sterling to £1,000,000, and having in its possession water power equal to 10,000 horse, and a staff of its engineers being now actively engaged in the environs of this city, I think it well to call the attention of the shareholders of the San Paulo Gas Company to this matter, and hope the Directors will, at the next half-yearly meeting, be able to give them assurance that their interests are not imperilled by this undertaking. The Engineer of the American Company is Mr. Pearson, of New York City, according to the "Rio News" of the 15th of August. This paper, in a previous number, furnished the information respecting the title, capital, and horse power of the Company as above given.

San Paulo, Brazil, Aug. 21, 1899. JAMES SOUTHALL.

[With reference to our correspondent's communication, we understand that the Company alluded to has been formed primarily for working tramways by electricity; and for this purpose a concession has been obtained. With the object of generating the electricity cheaply, the Company have purchased the Paranhyba Falls, near San Paulo. There is no doubt the Company is a strong one; and they have been doing their best to create a stir in the city. They are advertising that they are going to supply current for light and power at a rate which will defy the competition of other forms of lighting. This remains to be seen; and, moreover, they do not possess authority to supply electricity for lighting. The Municipal Government only this summer have passed a law which divides the city into sections for the purposes of electric supply; but the conditions are so onerous and prohibitive that no one can possibly do business under them. The new Company have petitioned the Municipal Government for power to supply electricity for light and motive force but they have been refused, unless they work under the new law. It may be remembered that the San Paulo Gas Company were going in for a scheme of electric lighting; but, in consequence of the new law, the Board, we believe, have cancelled the contracts for plant, and have decided not to proceed further with the scheme. Some authoritative information on this point will, no doubt, shortly reach the shareholders of the Company, who, it may be mentioned, hold the monopoly for the supply of gas and also for the public lighting.—ED. J. G. L.]

LEGAL INTELLIGENCE.

Damage to Gas-Mains by Electrolysis.

"Progressive Age" for the 1st inst. reports what is believed to be the first decision in an action brought against a railway company by a gas company for injury to mains by electric currents escaping from the rails. The litigants were the Spokane Falls (Wash.) Gas Company and the Street Railway Company; and, after the matter had been before the Court for nearly a year, owing partly to the non-observance of certain legal forms, the former have obtained a permanent injunction against the latter, it having been shown by the evidence that the gas-pipes had been injuriously affected by electrolysis, caused, at least partly, by the defective bonding of the railway system. It is laid down in the judgment that the only method of absolutely preventing stray currents of electricity is the double-trolley system; that the best single-trolley system is the cast welded-joint system; that the best wire bond is that known as the Chicago bond; and that it is not practicable to use cast welded joints except when the street is paved with asphalte, brick, macadam, wooden blocks, or similar material. The defendants are ordered to use cast welded joints in all paved or macadamized streets, and Chicago bonds in all other streets.

The Stamping of Hiring Agreements.

In the City of London Court last Thursday, Mr. Commissioner Kerr decided an important point in reference to agreements for hiring. A firm claimed £7 instalments due on the hire of a machine. The case had previously been before the Court, when objection was taken that the hiring agréement sued upon should have had a 6d. stamp. It was an agreement to pay for a machine by instalments. On the other hand, it was said that as the agreement was for the sale of goods it did not require a stamp. Many thousands of similar agreements were sued upon annually, and no Court had ever held that they should be stamped. Agreements for the sale of goods did not require any stamp, being specially exempted under the Sale of Goods Act. Mr. Commissioner Kerr held that the document must be stamped before it could be sued upon; it being above the value of £5. He nonsuited the plaintiffs, and gave the defendant his costs; telling the plaintiffs that they could sue again when they had stamped the document and paid the penalty.

Embezzlement by a Clerk of the Gaslight and Coke Company.

At the Westminster Police Court, on Monday last week, William Henry Moncrieff Roberson, 20, of Dunscombe Road, Hornsey Rise, was charged on a warrant before Mr. Horace Smith with falsifying the books of his employers, the Gaslight and Coke Company, and with misappropriating about £93. Mr. C. O. Humphreys prosecuted; Mr. T. D. Dutton appeared for the prisoner, who had been for a period of 4½ years in the service of the Company at their Camden Road office. Mr. Humphreys stated that the prisoner had shown a great deal of cleverness and ingenuity in carrying out his frauds. It was not a case of sudden temptation, but a very artful scheme of falsification of accounts; cheques from customers being held over and subsequently put into the cash-till, from which money of the exact value was taken. No receipts were sent for the cheques; and it was therefore impossible to say exactly what the defalcations were. After evidence had been given, Mr. Dutton said the accused would plead guilty at once. Mr. Humphreys stated that the prisoner had been betting, and guilty of other extravagances. Mr. Horace Smith said it was not a case which he could deal with under the First Offenders Act, because of the deliberate character of the fraud. He, however, took into consideration the youth of the prisoner, and sentenced him to four months' hard labour.

Unlawful Use of Water.

At Stratford, last Friday, a special Court of the Beacontree Division of Essex was held for the purpose of hearing 41 summonses taken out by the East London Water Company against persons for unlawfully using the Company's water for "other than domestic purposes." Mr. Gill, Barrister, with Mr. George Kebbell, Solicitor, appeared in support of the informations. Mr. Gill said there were a considerable number of cases in which the defendants had admitted that they had transgressed, and apologized; and in these the Company did not ask for a heavy penalty—the object being to stop the improper use of water. Among the defendants was the Dowager Duchess of Newcastle, who was represented by Mr. Bartley Dennis, Barrister. Mr. Gill said that in this case the summons was taken out in respect of a building known as Mornington House, Woodford, which was a charitable institution in which the Duchess was interested. She was the person rated in respect of the premises; and the Company always looked to her for the rate. At Mornington House there were some stables; and the Company's servants ascertained that water was being used in them—the hose conveying it to the stables being attached to a tap in the house. An explanation had now been offered, which the Company were glad to accept. It was not supposed for a moment that her Grace was responsible for this use of water. As a matter of fact, the servants in the house pumped water from a well into the cistern, which was also supplied by the Company's water, and the quantity so pumped exceeded that which the Company furnished. Had they known this before, the Company would have been pleased to withdraw the summons. After a few observations by Mr. Bartley Dennis, the summons was withdrawn. A number of cases were then called, and the defendants having explained that they did not know they were offending, fines of 5s. and costs were imposed. At the close of the proceedings, the Chairman said the defendants had been treated very leniently this time; but he would advise them not to be brought up again, or the fines would be much heavier.

MISCELLANEOUS NEWS.

THE GAS AND WATER ORDERS OF THE PAST SESSION.

The report of the Board of Trade on their proceedings under the Gas and Water Works Facilities Act, 1870, during the past session has been issued. It states that in December, 1898, twenty applications for Provisional Orders were made to the Board—thirteen relating to gas, and five to water undertakings, and two to gas and water undertakings combined. The amount of capital proposed to be authorized was £407,000 by shares and £112,166 by loan; and of the total amount (£519,166) £297,000 of share and £84,666 of loan capital was for gas, and £110,000 of share and £27,500 of loan capital for water purposes.

The applications for Gas Orders were in respect of Alton (Hants), Bedworth, Brigg, Elstree and Boreham Wood, Farnham, Freshwater, Herne Bay, Limavady, Morecambe, Newtown and Llanllwchaiarn, Tonbridge, Wellingborough, and York Town and Blackwater. Six of the applications—viz., those relating to Alton, Elstree and Boreham Wood, Morecambe, Tonbridge, Wellingborough, and York Town and Blackwater—were in respect of undertakings already authorized by Acts of Parliament or Provisional Orders. The Alton and York Town Companies sought authority to construct additional works; the Elstree, Morecambe, and Wellingborough Companies, power to raise additional capital; and the Tonbridge Company, power to construct additional works and to extend their area of supply. Six applications—viz., those in respect of Bedworth, Brigg, Farnham, Herne Bay, Limavady, and Newtown and Llanllwchaiarn—were for authority to maintain and continue existing gas-works; and in the Farnham case, power was also sought to construct additional works. One application—that of the Freshwater Gas Company, Limited—was for authority to construct and maintain new gas-works. Objections were lodged against several of the applications. These were fully considered by the Board of Trade, and Orders were granted in every instance, subject to certain modifications and amendments.

The Order granted in the case of Brigg was not proceeded with, as, in the course of the inquiry before a Committee of the House of Commons on a Bill promoted by the Brigg Urban District Council for power to acquire the undertaking, an agreement as to the purchase clauses to be inserted in the Bill was arrived at between the Council and the promoters of the Order. In the case of the Freshwater application, a number of objections were received; and the Board of Trade appointed Lieut.-Col. H. A. Yorke, R.E., to hold a local inquiry, and report to them upon the application. He reported that all the local and road authorities concerned had consented to the application, subject to the insertion in the Order of certain agreed clauses; and, as some means of lighting the parishes of Freshwater and Totland was urgently needed, he recommended that the Order be granted. The objections urged against the application on the ground of unsuitability of the proposed site, and prospective nuisance to private houses in the district were not, in Colonel Yorke's opinion, sustained. On consideration of the report the Board decided to grant the Order, subject to modification and amendment.

In the case of the Tonbridge application, the promoters were unable to obtain the consents of the Sevenoaks Rural District Council and the Hildenborough Parish Council; and the Board of Trade were asked to exercise the power conferred upon them by section 4 of the Gas and Water Works Facilities Act, 1870, of dispensing with such consents. The Board appointed Lieut.-Col. Yorke to hold a local inquiry; and upon his report they decided to dispense with the consents of the Authorities in question, and to grant an Order, subject to certain modifications and amendments as regards price, &c. A special report was made to Parliament on the matter, in compliance with the provisions of section 4 of the above-named Act; and an abstract thereof was given in the "JOURNAL" on July 18 last (p. 186).

In the cases of Morecambe, Brigg, Farnham, and Newtown and Llanllwchaiarn, the respective Local Authorities desired the insertion of a clause in the Orders requiring the promoters to sell their undertakings. The promoters strongly objected to the proposed clause, and in each case a meeting between the representatives of the parties was held at the office of the Board of Trade. In the case of Morecambe, which was promoted by a Company already possessing parliamentary powers, the Board decided not to entertain the proposal. In the other cases, which related to undertakings existing without statutory authority, the Board subsequently informed all parties that hitherto a clause requiring a company to sell to a local authority had not been inserted in Provisional Orders when the promoters objected to it; that the promoters had questioned whether Parliament had given sufficient sanction to the insertion of such a clause generally in Bills to justify the Board in attempting to insert it against the wishes of the promoters; and that, under the circumstances, they had decided to grant the Order without the suggested clause, and without expressing any opinion that might prejudice the position of either side in case the question should have to be decided by Parliament in connection with the Confirmation Bills. The Brigg Order was, as previously stated, subsequently withdrawn. The Farnham and Newtown Orders were opposed in Parliament; and the Committee of the House of Lords, to which the Confirmation Bill containing these Orders was referred, inserted purchase clauses at the instance of the respective Local Authorities.

In the following Orders, a maximum price per 1000 cubic feet of gas was fixed; power being reserved to the Board of Trade, after three years, to alter it or to substitute a sliding-scale: Bedworth, 5s. 3d.; Farnham, 3s. 9d.; Freshwater, 5s.; Herne Bay, 4s. 2d.; Limavady, 6s. 3d.; Newtown, 4s. 7d. In the Elstree and Boreham Wood Order, the existing authorized maximum price of 6s. was maintained, but with power to the Board of Trade to revise it after three years. The Tonbridge Order provided that in the extended area authorized the promoters might charge not more than 9d. above the price charged for the time being in the existing area subject to a maximum price of 4s. 6d.; the existing area being already subject, under a previous Order, to a sliding-scale price of 3s. 9d.

The sale of gas in bulk beyond the limits of supply was authorized, subject to the usual limitations, in the Elstree, Farnham, Freshwater, Herne Bay, Newtown, and Tonbridge Orders. The usual minimum of 15-candle illuminating power of the gas to be supplied was prescribed where necessary.

Special provisions were inserted as follows: In the Herne Bay Order, with regard to the capitalization of certain premiums obtained from the issue of original capital; in the Farnham and Newtown Orders, with reference to the dividends payable on the share capital; and in the latter Order, making the issue of mortgages subject to the auction clauses; and in the Tonbridge Order, with respect to the price of gas supplied to the Urban District Council of Tonbridge. The Herne Bay and Freshwater Orders contained agreed clauses as to the purchase of the undertakings by the Herne Bay Urban District Council and the Isle of Wight Rural District Council respectively.

The applications for Water Orders were in respect of Burnham and district, Harpenden, Maidstone, Stourbridge, and Tilehurst, Pangbourne, and district.

The Burnham, Harpenden, Maidstone, and Tilehurst applications were for additional capital in respect of existing undertakings; and that of Stourbridge was for an extension of the limits of supply, and for additional capital. All the applications were granted, and Orders were made, with such amendments in detail as appeared desirable.

There were two applications from Companies already authorized by Provisional Orders. The Hoylake and West Kirby Gas and Water Company, Limited, applied for authority to raise additional capital, and an Order was granted, subject to some modification of the proposals of the promoters. The Laindon Gas and Water Company, Limited, applied for power to extend their district for the supply of water, and to construct gas-works and supply gas; their powers as regards gas under their previous Order having lapsed. The promoters failed to produce the consents of certain Local and Road Authorities concerned, and asked the Board of Trade to dispense therewith. The Board appointed Lieut.-Col. Yorke to hold a local inquiry; but he was unable to recommend that the consents of the Authorities in question should be dispensed with, and the Board of Trade declined to grant an Order.

Four Bills—viz., the Gas Orders Confirmation Bills (Nos. 1 and 2), the Water Orders Confirmation Bill, and the Gas and Water Orders Confirmation Bill—to confirm the foregoing Orders were introduced into the House of Lords on the 1st of May. The Gas Orders Confirmation (No. 2) Bill was opposed in respect of the Farnham and Newtown Orders, and was referred to a Committee, who inserted clauses empowering the respective Local Authorities to purchase the undertakings. No other opposition was offered to the remaining Orders; and the Bills passed through the various stages, and received the Royal Assent on the 1st of August, except the Gas Orders Confirmation (No. 2) Bill, which reached its final stage on the 9th.

The number of Orders applied for since the passing of the Gas and Water Works Facilities Act, 1870, is 499; and the Board of Trade have made 462 Orders, of which 453 have been confirmed by Parliament.

SHEFFIELD UNITED GAS COMPANY.

The Eighty-ninth Ordinary General Meeting of this Company was held last Tuesday—Sir F. T. MAPPIN in the chair.

The GENERAL MANAGER and SECRETARY (Mr. Hanbury Thomas) having read the notice convening the meeting, the report and accounts, summarized in the "JOURNAL" for the 29th ult., were taken as read.

The CHAIRMAN, in moving the adoption of the report, pointed out that the net profit made during the half year ending June 30 amounted to £43,008; and after paying the dividend, a balance of £468 was left to be carried forward to the previous balance—making altogether £18,452 to the credit of the present half year. The reduction of 2d. per 1000 cubic feet made in April, 1898, was equivalent to a decrease of £10,295 on the half year; but the Company were fully justified in making the change—the reduced prices being 1s. 10d., 1s. 8d., and 1s. 6d. per 1000 cubic feet. The consumer had benefited to the extent he had already indicated; and the shareholders had not been prejudiced in any way, for they had received their usual dividend during that period. The reserve fund was at its maximum—viz., £86,192. The increase in the quantity of gas sold during the half year had been very remarkable—viz., 130,084,000 cubic feet, or equal to 11·76 per cent. He had read a number of reports of gas meetings; but he had seen none which had shown an increase exceeding that of the Sheffield Gas Company during the past six months. It was continuing during the present half year, and already amounted to more than 26 million cubic feet. As to the accounts, £5685 more had been received for gas than in the corresponding period of last year, £5119 more for coke, and £5485 more for sulphate of ammonia. On the other side of the account, coal had cost £7142 more, purifying materials £658 more, stokers' wages £3092 more, and repairs of works £4092 more. The latter was a large item; but he thought that spending money in maintaining the works in an efficient state of repair was a very valuable expenditure. The Company had contributed £500 to the Royal Hospital Fund, and they had to pay £704 more dividend. This left the balance of £468 to add to the previous balance. The use of gas-engines was becoming more appreciated. Fifty-two were fixed during the half year; and 129,941,000 cubic feet of gas had been consumed during the past twelve months by gas-engines. He felt satisfied that this item would go on increasing, and that it would not require much energy on the part of the Company to augment the number of gas-engines in use in Sheffield. The Company had sold 354 gas-fires and 405 boiling and other stoves; and 237 additional gas cooking-stoves had been let on hire. Sheffield did not progress very rapidly in the adoption of gas-fires. He had noticed that they had become almost the rule in Leicester, where the average sale was about 260 weekly, while on one day orders for 290 were received. If Sheffield in any way approached this state of things, the consumption of gas would be very largely increased. The gas was tested 1096 times during the six months; and the average illuminating power equalled 17·53 candles. He would now turn from the financial side of the working of the Company, with which they must all be fairly satisfied; and although he could not say that he himself was so satisfied as he thought he ought to be, he trusted they were in a better train, and would have fewer difficulties in the future than they had had recently. At the meeting six months ago, he explained pretty fully the trouble that had been caused by the presence of

naphthalene in the mains and services, and the steps taken to remedy it. Four gas-works where there was no naphthalene were visited, and also four others where they had the trouble as they had it in Sheffield. They secured all the statistics available, and obtained much information about the modes of working, the temperatures at the inlet and outlet of the condensers, and so forth. With this information before them, they began to think that they had arrived at a solution of the difficulty. They were sustained in this hope because in January their complaints had fallen to 144, in February to 45, and in March to 17. Out of 58,000 consumers, the fact that only 17 should complain of want of gas from one cause or another was certainly not a very serious matter. They soon found, however, that they were disappointed in their hope that they had shaken themselves free from their difficulties. The trouble had returned, and was as bad as, if not worse than, before. So far as he could ascertain, no remedy for it had been found, though there were many ideas and views upon the subject. Numerous cures had been suggested; but hitherto all of them appeared to have failed. One gentleman suggested the use of paraffin oil; another said that 200 gallons of creosote would dissolve the naphthalene in 10 million cubic feet of gas; another suggested passing the gas through a large excess of benzene; and another, the washing of the naphthalene-charged gas with hydrocarbon fluid. The Chairman next referred to the existence of a large number of houses in Sheffield in which the gas-pipes were only ¼ inch or ⅜ inch in diameter. This was the case in houses other than those having only two or three rooms; and people could not expect a good light when such small interior pipes were employed. Passing on to the subject of incandescent gas lighting, the Chairman said this light was now so commonly used that the maintenance of mantles and burners was being undertaken by gas companies at a fixed charge per annum. He was convinced that the incandescent gas-light would be the light of the future; and he did not hesitate to make this assertion because the electric arc lamp was being very much superseded by the incandescent gas-light, on account of the one being so expensive and the other so economical. By the light of the arc lamps, when they were placed at a considerable distance apart, deep shadows were cast. In Prince's Gate, his residence in London, a system of single incandescent gas-lights had been introduced; and he had never seen an installation in any city or street equal to it. Bolton had adopted a double incandescent light on account of its cheapness and efficiency; and at Sandringham the electric light had been replaced by the incandescent gas-light. The terminus of the Great Central Railway in London was well worth seeing by those who were interested in public lighting. It was lighted by 19 gas-lamps of 1000-candle power, 3 of 670-candle power, and 14 of 335-candle power. He was told that the entire lighting of the platforms, promenade, booking hall, and parcels office was covered by a remarkably small charge. The Somzée-Greyson incandescent burner was used, and the total cost of the gas and water to produce light equal to 25,000 candles was only 2s. 6d. per hour. It appeared almost incredible; but Mr. George Livesey, who was an authority on this subject, stated, in reference to this system of gas lighting, that gas consumed in this way far surpassed the electric arc light in efficiency, while as regards economy the latter was simply nowhere. Throughout the country gas consumption had not been affected by the introduction of electric light in the way which everybody anticipated it would be. In 1887, 90,600 million cubic feet of gas were used in the United Kingdom; in 1897, 132,000 millions; and last year, 140,600 millions. Sheffield evidently was not the only place where the use of gas was on the increase. No doubt electricians would go on effecting improvements which might reduce the cost of electricity. Gas engineers had the same object before them; and the introduction of incandescent gas lighting and other developments proved that gas was, like the electric light, still in its infancy. Therefore those gentlemen who had invested their money in gas undertakings need have no doubt as to the future.

Sir H. Stephenson seconded the motion, and it was carried.

The usual dividend having been declared, Sir H. Stephenson, Mr. E. Hall, and Mr. Wilson Mappin were re-elected to their seats on the Board; and the proceedings closed.

BRADFORD CORPORATION GAS ACCOUNTS.

The Half-Yearly Statement.

At the Meeting of the Bradford City Council last Tuesday, Alderman Speight, the Chairman of the Gas and Electricity Committee, made the customary statement respecting the outcome of the working of the Gas Department during the six months ending June 30 last.

Alderman Speight, in moving the adoption of the minutes of the Committee, stated that during the half year 80,569 tons of coal and cannel were carbonized; being 4007 tons more than in the corresponding half of 1898. The gas made amounted to 833,705,000 cubic feet, which was an increase of 37,000,000 feet (or 4·36 per cent.) upon the production in the corresponding half of the previous year. Regarding the bye-products, 33,938 tons of saleable coke, 5278 tons of tar, and 11,725 tons of ammoniacal liquor had been made; each item showing an improvement on the previous year in the quantity produced per ton of coal carbonized. The average cost of the coal and cannel used was 10s. 0·15d. per ton; being ¾d. per ton less than in 1898, owing to the Committee having made their coal contracts at a very favourable time. On account of the recent advances in prices, the coal required for next year would cost considerably more. Residuals had done better during the past half year. Coke had yielded an average of 10·82d. per ton more, and sulphate of ammonia £1 11s. per ton more; but tar, owing to the serious fall in prices, showed an average decrease of 4s. 1·16d. per ton. A new contract had been made for next year's production of tar at a much better price. The expenditure and revenue account for the half year was, he considered, very satisfactory. Coal cost £41,056, which was £1744 more than in the first half of 1898; purification cost £1456, or £205 more; engineers' salaries amounted to £635, or £76 more. Wages for carbonizing reached £10,775; being an increase of £555. The repairs to works cost £2824, or £660 less; repairs to retorts £1847, or £824 less; yard labour and sundries £2151, an increase of £17; repairs to mains and services £2239, or £383 less; and meter repairs £1697, or £884 more. Inspection of meters involved an expenditure of £1208, or £115 more than in the corresponding half of the previous year. Lighting and repairs of public lamps cost £4844, an increase of £208. The rents payable by the Committee were £211, or £21 less; rates and taxes £3107, or £177 more; clerks' salaries £725, or £19 more; and collection of accounts £250. Gas, water, and sundries cost £1671, or £49 more; and gas cooking-stoves and fires £300. Bad debts were estimated at £465—an increase of £19. On the revenue side of the account, the receipts from the sale of gas amounted to £76,645, or £1713 more; and the hire of meters came to £306, or £10 less. Coke produced £10,015, or £2042 more; and tar £4247—a decrease of £662. Ammoniacal liquor, as charged to the chemical works, yielded £5853, or £1416 more than in the corresponding half of last year. The manufacture of chemicals had realized a profit of £2906, or £94 more than in the first half of 1898. The spent oxide was sold for £1196—an increase of £442. The sale of meters returned £1434, or £259 more. Rents payable to the Committee amounted to £539, an increase of £7; and sundries to £246, or £323 less. The gross profit for the half year was £25,786, out of which £8569, or £90 less, was charged for interest on loans. The sinking fund absorbed £4722, being an increase of £125; bank interest came to £204, or £14 less; and £1039 had been paid for income-tax. The net profit on the working of the undertaking for the half year was £11,248, or £2345 more than in the corresponding half of last year. The net profit for the six months was more than in any of the corresponding periods since 1880. In the first half of that year, the net profit was £14,014; but £4572 was then charged for the gas used in the street lamps, and the selling price of gas was 9d. more than at present. If the Gas Department charged for the street lamps at the ordinary rate, the net profit for the half year would be increased to £22,703. The only expenditure charged to capital account had been £824 for the chemical works, and £863 for mains in new streets. The total capital spent upon the works up to June 30 was £622,328, of which £152,421 had been repaid through the sinking fund. The unappropriated profits arising out of the Gas Department up to December, 1898, amounted to £52,703. From this had to be deducted the appropriations made during the half year of £7700 to the city fund, £7250 to the general district rate, and £3000 to the water account—a total of £17,950, which left £34,753. When to this amount was added the profit from the half year of £11,249, the unappropriated balance reached £46,002.

Mr. W. C. Dixon seconded the motion.

Mr. Foster urged the desirability of reducing the price as persons who did not use gas at all, but had their own installation of electricity, shared in the benefits of the profits contributed by the gas users.

Mr. Riddiough asked for a reduction in the price of gas in Frizinghall; and Mr. W. Knight said that cheaper and better gas was wanted at Allerton.

Alderman Speight said, regarding Mr. Riddiough's request, that Parliament had been asked to grant powers for the purchase of the concern of the Shipley Gas Company, so far as related to the district in question; but the powers had been refused. Therefore Mr. Riddiough must seek redress at Shipley. It was eminently desirable that the gas-works should continue to make a profit rather than that the price of gas should be reduced, as in any case of necessity the profits could be drawn upon.

The motion was adopted.

THE SUGGESTED INCREASE IN THE PRICE OF GAS AT MIDDLESBROUGH.

The Administration of the Department Criticized—The Proposal Referred Back.

The minutes of the Gas Committee, containing the recommendation to increase the price of gas by 2d. per 1000 cubic feet, were presented to the Middlesbrough Town Council last Tuesday. On their introduction, Alderman J. F. Wilson moved that the advance be 4d. In support of his proposal, he said that estimates were presented in April based upon a certain revenue; and he felt it was exceedingly important that nothing should interfere with the estimates of any Committee. But since April a good deal had happened. There would be a considerable increase in the cost of production; and they had before them certain repairs to the gasholder tanks, costing at least £1500 or £1600, which should be provided out of revenue. If the increase were not granted, they would be left with a debit; and the figure he proposed was certainly justified by the enhanced cost of material and labour. Alderman Hinton seconded, remarking that they could only expect £16,628 profit from the gas-works on the increase suggested, and £16,500 would be required for interest, redemption, &c., to meet the estimates as presented. He felt that £128 was too small a margin to work on. Alderman Archibald regretted any amendment had been moved. They had tried 3d., but miserably failed. The argument for an increase of price was the addition to capital and the extra cost of material; and he could but feel the estimate presented early in the year was a wild one. The increase would not come out of the ratepayers' pockets; for it was the consumers who had to buy the works and pay for all the blunders. Mr. Forbes counselled a reduction in expenditure rather than an increase in the price to the consumers, who were complaining of the quality of the gas. The ratepayers, in his opinion, should be asked to meet any deficiency, as they had in the past reaped some of the benefits of the undertaking. Alderman Bulmer opposed such a suggestion. The town was liable for £218,000 still debited against the gas-works. Mr. Roberts quoted figures to show that the cost of material and labour was less than the average for years past. The situation, he felt, was wholly due to the extravagant expenditure at the works; and the only way to bring the Committee to see the real cause was to allow the sum to go upon the rates proper, and then the ratepayers would look to it. The expenditure, to his mind, was excessive, considering what they obtained in return. They were told that, as regards the water undertaking, the more water there was consumed, the better it would be for the ratepayers; but in the case of gas, the more gas made seemed to mean greater cost. Mr. Burrows did not know where Alderman Hinton procured his figures; but he thought if the consumer paid for interest, redemption, and expenses, it was as much as they ought to expect. Mr. Baker hoped to be able to show that even the 2d. increase was not needed. A sum of £5000 was put down for increased expenditure on material. They had bought 30,000 tons of coal

paying 2s. per ton more than last year. This only meant £3000. Oil had been contracted for at a favourable time; and the price was about the same as last year. This meant £4000 to be found, including the additional £1000 required for interest and redemption; but he thought there had been such an increase in the price of residuals that everything pointed to a greater profit.

Replying upon the discussion, Alderman Hugh Bell said he would have been content with the 2d. increase; but as Alderman Wilson, the chancellor of the exchequer, had felt disposed to test the meeting for 4d. increase, he should vote for him. Alderman Hinton's position was, he thought, very simple. The estimate last March was for an expenditure of about £29,000; and this, with the increase of £5000 for material, would mean that they must have an income of about £50,000. In order to obtain this, it was necessary to increase the price of gas to 2s. 4d. net. It had nothing to do with interest and redemption, but with the estimates. But what were the present profits of the gas-works, and what were they likely to be? Mr. Baker had endeavoured to persuade them that the estimate before the Committee was wrong. They would, however, consume 35,000 tons of coal, by which £3500 more was absorbed than last year. But lime, oxide, stores, &c., had increased in price, and £1500 was not an unwise estimate of the Accountant, advised by the Gas Manager. The view that had always been taken with regard to gas-works was that they must be treated as a commercial undertaking; and taking all risks into account, the net return on capital ought to be 8 or 10 per cent., out of which to pay interest and redemption, and accumulate a reserve fund, or pay into the rates. In 1889 they had 8 per cent., but now it was 4·4 per cent.; and he would ask the Council to regard this in the light of trustees of shareholders, and not as consumers. No one was more ready than he to submit to criticism on the management of the gas-works; but he liked that criticism to be well informed, which he ventured to say it was not on this occasion. Mr. Roberts had said there was no increase in the price of labour. The cost of labour per 1000 cubic feet of gas made was indeed lower; but this had been done as all manufacturers in the district were doing—by an increase of capital account. There were, moreover, in the present gas-works thousands of pounds put in foundations and in brickwork which would not produce any profit, but which nevertheless went to swell the capital account. This would still go on until they had spent £30,000 or £40,000; but they were now doing work which would serve to supply the town for the next 25 or 30 years. It was easy, too, for Alderman Bulmer or anyone else to criticize, and say they ought not to have done this or that. It was his (Alderman Bell's) unfortunate position to be always giving advice; but they did not choose always to take it. He advised going away from the present site and building upon another; but as they did not agree, the management had been obliged to do the best they could on the small site. But it was not because of this expenditure that they asked for an increase in the price of gas. They were not in a different position from other towns. Stockton had had to do it. Why did they hesitate?

The motion for an increase of 4d. was lost; and Mr. Baker moved another amendment referring the whole matter back to the Committee. The effect of this would be, said Alderman Bell, that the Committee would lose a quarter's charge. Further discussion followed, in the course of which Mr. Mattison said he wanted the matter of the management probed to the bottom. The whole thing had always been in a turmoil. The amendment was eventually carried by 18 to 13 votes.

CARLISLE CORPORATION GAS AND WATER ACCOUNTS.

The Gas Profits, the Rates, and the Consumers.

At the Monthly Meeting of the Carlisle Town Council last Tuesday, the annual report of the Gas and Water Committee was presented. The gross profits from the gas-works, it stated, amounted to £8758; and the balance available for the city fund was £6713. The gross profits from the water-works were £5983; and the sum available for the district fund was £4764. The minutes of the Committee showed that £500 had been placed to the credit of the reserve fund, and that it had been decided to spend £400 upon an additional pump for the water-works, to meet the difficulty experienced in maintaining the supply of water to the higher parts of the city and district.

Mr. Corbett in moving the adoption of the report, said he had great pleasure in doing so, because it again showed a considerable advance in the amount of profit which had been realized from both gas and water. In the gas accounts they would see that the gross profits were £9694, about £605 more than last year, notwithstanding the great increase in price of coal during the year, and that the consumption was 2100 tons more, costing £1836. The consumption of gas was 15,194,000 cubic feet in excess of last year—an increase of 5·38 per cent., which, he thought, was very good indeed. The revenue from the sale of gas was more than last year by about £1620. The residual profits were also very good, amounting to £994 more than the year before—coke being £363 more, tar £130, and ammonia and other residuals £500. After deducting income-tax, and placing £500 to the reserve fund, the amount to be handed over to the city fund was £8758. But out of this sum, the Finance Committee would pay £2045 for interest in the redemption of loans; leaving a balance of £6713 available for the relief of rates or any other purpose the Finance Committee might use it for, which was an increase of £565 over the preceding year. With regard to the water, he was glad to say the business showed a very considerable expansion over last year; the revenue having been £9759 as compared with that of the previous year, which was £9272—an increase of £487. The quantity of water pumped during the year was above 445 million gallons, equal to a consumption of nearly 26 gallons per head of the population; showing an increase of ¾ gallon over the quantity last year. The amount payable to the district fund from the water profit was £5983, as compared with £5896 last year; and the amount payable out of the district fund would be £1218, leaving a net balance of £4764 to pay to the district fund—an increase of £283 over the result of last year's working. The combined profits from gas and water available for the relief of rates, after all expenses were paid, were £11,477, as compared with £10,629, an increase of £848. Although the gas profits were so large and satisfactory this year, he was afraid they could hardly expect such good results next year—in the first place, from the fact that they would have to pay about £2000 more for coal. Then here might be a considerable reduction in the consumption of gas owing to the electric light; and the question of extending the works was waiting this further development. But, on the other hand, they hoped to get an increase in value for tar and coke, sulphate of ammonia, and other residuals, which would to some extent compensate for the great additional cost the Committee might be subject to. With regard to the water supply, great difficulty had been experienced for some time in supplying the high levels in the city and district, although two pumps had never ceased to work night and day. To overcome this difficulty, it was proposed to put in a steam-pump to tide them over until the new scheme was ready. It would be simply an auxiliary, and would cost about £400; and the Manager assured them it would amply meet all requirements.

Mr. Coulthard, in seconding the motion, said he might point out that, out of a collection of £42,000, there was only £49 of bad debts. He thought the progress made in the water returns was even better than that of the gas; for if they referred to the return in 1895, they would find it amounted to £2080, as compared with £4764 this year—the latter being more than double the former. This showed that, if they went on progressing in the way they were doing at present, by the time the new works were constructed, they would be able to pay the yearly principal and interest, and leave a balance for further improvements.

In the discussion which followed, suggestions were made that a discount should be granted to consumers for prompt payment, an allowance made to large gas consumers, and that meter-rents should be abolished.

Mr. Corbett, in reply, said as to the suggestion that an allowance should be made for early payment of accounts, he had only to refer to what Mr. Coulthard had stated, and which showed that the consumers paid their accounts fairly well. With regard to the abolition of meter-rents, the matter had been before the Committee; and the Engineer (Mr. C. B. Newton) had instructions to get information with regard to it.

The Mayor (Mr. G. White) thought the Engineer and Committee were to be congratulated on the general result of the year's working. He also pointed out that it was greatly owing to the large amount of gas profits, that they had no city rate; so that, if they did not get a return in the shape of a reduction in the price of gas, they still derived a very large benefit. They had had no city rate to pay for eleven years.

Mr. Buck said what the Mayor had pointed out was no reason why large consumers of gas should supply ratepayers of the city with the means of providing a reduction of their rates. The suggestion for the abolition of the meter-rents did not trouble him much, but he thought that, as in other towns, there should be a special discount to large consumers of gas.

Mr. Phillips disagreed, and thought they should rather aid small struggling consumers than make concessions to people who consumed a great deal. One of the evil principles of commerce in this country was that of making concessions to large consumers. It imposed a burden upon, and was a bugbear to, people in a small way of business.

Mr. French, while not arguing against concessions to small gas consumers, considered they might be made to those who burnt largely.

Mr. Scott said the spirit which had always animated the Gas and Water Committee was this: The gas and water concerns were owned by the whole population, rich and poor alike; and they had always put down their foot against making concessions to large consumers, because it was taking from the poor to give to the rich. It was unfair to do anything of the kind; and he hoped the Committee would always act on the policy on which they had hitherto gone. It had often been suggested, with a certain amount of plausibility, that they should reduce the price of gas in order that people who used engines might get their gas cheaper. He had not seen his way to agree to this, although personally it would have made a great difference to his pocket. When they had gas at 2s. 3d. per 1000 cubic feet, they must remember that it was cheap. If the gas were not cheap, the argument of reducing the price to large consumers might tell more; but considering that it was very cheap, he did not think it would be in the interests of the public to make any concessions of the kind. Seeing, however, that they made a profit of £6713, he was largely in sympathy with the idea of doing something either to reduce the price or abolish the charge for meter-rents. With regard to the latter, they were met with the difficulty that some people had bought out their meters; and they would have to be paid their present value. The Committee had considered this pretty often; and the Manager had been instructed to get information from other towns. He hoped before long a proposal might be made; but he did not say that it would be. Further, he did not think they should show this large profit every year. In one respect it was slightly unfair. For instance, they supplied the Town Hall and all the public buildings with gas at 2s. 3d. per 1000 feet, so that there they were showing a fictitious profit. And there was also the public lighting of the streets. He had an idea that they were making a profit out of this; and he thought it time these things were revised. Nor did he think they should charge as they did for watering the streets, because practically it did not cost the Water Committee anything but the pumping charges. He hoped someone would take an opportunity of going into these things and putting them on a sounder basis. They had been proceeding in the present way for 20 or 30 years; and as the town had increased, it would be wise to consider their position and do things a little more fairly.

Mr. Buck pointed out that the rates of the poor were paid through their rents; and they were not affected. But he did not see why large consumers should assist in making excessive profits, in order that those who lived in the better part of the city, and were considerable ratepayers, should have their rates reduced.

Mr. Tweedy said there was a feeling in the Gas Committee that the time had arrived when they should see if something could be done instead of making these huge profits. There was the electric light now, however; and it might be prudent to wait and ascertain how that affected them. He had no doubt the working of the gas undertaking would still be satisfactory, and there was no doubt that next year they would have to consider seriously what could be done. If a reduction was made in the price of gas, he hoped it would be universal.

Mr. Corbett further remarked that every subject that had been mentioned had been before the Committee for years. The difficulty about the meter-rents mentioned by Mr. Scott was a great one; and if the rents were abolished, a large sum would have to be paid to those who had bought their meters. Next year he expected the profits would be less; but they should remember that the gas was cheap.

The minutes of the Committee were then confirmed.

PROPOSED INCANDESCENT GAS LIGHTING FOR LAMBETH.

At the Meeting of the Lambeth Vestry last Thursday, the Lighting Committee brought up a report in which they stated that they had had under consideration the incandescent gas system for the public lighting of the district supplied by the Gaslight and Coke Company. The Company were willing to introduce the system on the following terms: To supply and fix "Brixton" pattern cylinder lanterns, with No. 4 incandescent burner and fittings complete (about 170), at 70s. 9d. per lamp. To adapt and fit with a No. 2 incandescent burner the present old pattern lanterns (about 634) with fittings complete at 33s. 9d. per lamp; and to afterwards light, extinguish, clean, and maintain the lamps on the incandescent system, at a charge of, for the lamps fitted with No. 4 burners, 68s. 4d. per lamp per annum, and for the lamps fitted with No. 2 burners, 51s. 8d. per lamp per annum. The initial cost (about £1671) to be borne by the Company, and repaid by the Vestry by equal quarterly instalments spread over a term of three years. The gas in the district is now supplied to the public lamps on the average meter system; and the Committee expressed the opinion that it would be more satisfactory for a specified charge to be made at per lamp per annum, as suggested, which was already the system in the case of the other two Companies supplying the parish. The Committee went on to say: "Although the initial cost is 20s. 9d. more in the case of new lamps with a No. 4 burner, and 13s. 9d. more in the case of altered lamps with a No. 2 burner, than the charge made by the South Metropolitan Gas Company, who are bearing a part of the initial cost in their district, the Committee recommend that the lamps (about 170) on the Albert Embankment, and in Kennington Road, Lower Kennington Lane, Upper Kennington Lane, Stangate, and Westminster Bridge Road be fitted with the 'Brixton' pattern lantern and No. 4 burner; and that all the other ordinary lamps (about 634) in the Gaslight and Coke Company's district be adapted and fitted with a No. 2 incandescent burner. The new lamps to be fitted and the old pattern lanterns adapted for incandescent lighting, and all work in connection with the same to be completed, within twelve months from the date of the order. The charge for gas for the future to be the fixed sum per lamp as offered by the Company, subject, of course, to the ordinary rule, that on all reductions in the charge for gas to ordinary consumers the fixed yearly charge for public lamps is to be reduced in proportion. This system of incandescent lighting and a fixed yearly charge per lamp, if carried out, would effect a saving in the Gaslight and Coke Company's gas account of upwards of £300 per annum, in addition to improving the lighting of the streets in the district."

In moving the adoption of the report, Mr. Williams remarked that, although the agreement was not so favourable as that made with the South Metropolitan Company, it would still be advantageous to the parish. Mr. Howlett moved, as an amendment, that the consideration of the matter be adjourned for six months, as the proposed bargain would not be a good one. The South Metropolitan Company were putting in new lanterns, while the Gaslight and Coke Company were only to fit up the old ones, which were altogether unsuited for incandescent lighting. The most important point, however, was that the Parliamentary Committee which had recently been sitting had strongly recommended that the South Metropolitan Company should absorb the district of the Gaslight and Coke Company south of the Thames. No doubt this would be carried out in the immediate future; and when it was accomplished the first-named Company would be only too glad to accept the terms they had previously offered to the Vestry, and which had been agreed to. That Company had served not only the parish but private consumers well in the past. No time would be lost by deferring the matter for the present, as the work could not, in any case, be commenced before the spring. The amendment was carried by 48 votes to 6.

THE COMPETITION FOR THE PUBLIC LIGHTING OF NEWMARKET.

Success of the New Incandescent Gas-Lamps.

Reference was made in the "JOURNAL" last week to the successful inauguration of the incandescent system of gas lighting at Newmarket on the 1st inst. No sooner was the Gas Company's tender accepted than the energetic Manager (Mr. J. H. Troughton) set to work to get the lamps fitted with the new burners, with the result that we have the testimony of the "Newmarket Journal" that the town "has never before been half so well illuminated as it is at present. The new incandescent burners are giving a splendid light; and it may safely be claimed that Newmarket is now one of the best lighted towns in the Eastern Counties. If the lights are kept up to the present standard during the next three years—and there is no reason to doubt that the Gas Company will do their utmost to fulfil their contract to the satisfaction of the Council—there will certainly be no cause for complaint with regard to public lighting." In the same paper, we notice a bitter pill for the Electric Light Company, and an eye-opener for the inhabitants of the town, in the shape of a boldly displayed advertisement, which reads: "Gas *v.* Electricity. Which is the cheapest? The Newmarket Electric Light Company sent in a tender to the District Council to light 174 public lamps, of 16-candle power each, at £3 per lamp per annum. The Gas Company (whose tender is accepted) are lighting the same number of lamps, with 80 to 90 candle power incandescent gas-burners, at £3 9s. per lamp per annum. For approximately the same money, the Gas Company are giving from five to six times more light than the Electric Light Company offered. This is proof that gas is at least five times cheaper than the electric light. Caution: Users of electric light are cautioned not to have their gas-fittings removed. They cannot tell how soon they may require them."

Reductions in Price.—The price of gas at Wrotham and Borough Green has been reduced to 4s. 6d. per 1000 cubic feet. The Gas Committee of the South Molton Town Council have reduced the price of gas by 5d. per 1000 cubic feet.

SALES OF STOCK AND SHARES.

Last Thursday Mr. George Nichols (of Messrs. Nichols, Smith, and Alder) sold at Bristol £16,000 of 5 per cent. maximum general capital stock of the Bristol Gas Company, and £4000 4 per cent. debenture stock. The additional capital, he explained, was required to meet the greatly increased demand for gas; 14 miles of new mains having been laid, and 1476 new services supplied in the past year. The increased output of gas last year was 7 per cent. The buying of the £16,000 worth of general capital stock started at 124½, and rose to 124¾ for a few lots. A good batch fetched 124½. Then came a gradual drop to 123, and a finish at 123¾. The average price was £123 19s. 3d. For the £4000 worth of debentures, there seemed to be but little demand. One lot sold at 130, five at 128, and three at 127. The rest were not offered. The average price was thus £127 16s. At Chelmsford, Mr. Fred Taylor has recently sold a number of £5 shares in the Brentwood Gas Company, Limited, and the Harwich Gas Company. The Brentwood shares (68 altogether), on which the last dividend paid was 10 per cent., were sold for £34 10s. per lot of three; and the remaining lots varied from £35 10s. to £36 10s. There were 40 £5 shares in the Harwich Company offered. On 32 of these the last dividend was 8¾ per cent. Thirty of them were disposed of in lots of three each; and the prices ranged from £25 10s. to £26 10s. each lot. Two similar shares fetched £18 10s. Four shares, on which the last dividend was 6 per cent., realized £25 10s.; and four others produced the same price. Messrs. Catling and Son last Tuesday submitted to public auction at Cambridge £2362 10s. of consolidated stock in the University and Town Water Company. The maximum dividend of 10 per cent. has been paid on this stock for the past quarter of a century. The total amount realized was £7281 19s. 6d. On the same occasion, £2000 of consolidated stock in the Trowbridge Water Company, on which a dividend of 4½ per cent. per annum has been paid for some years, yielded a total of £2460. Messrs. J. Reeve and Son disposed on Monday last week of some Margate gas stock on which the Company have paid 5½ per cent. Four lots of £50 fetched £70 each; one similar lot realized £71, two lots £69 10s., and one lot £69.

ELECTRIC LIGHTING NOTES.

The Warrington Town Council have agreed to make application to the Local Government Board for their sanction to the borrowing of £44,966 for purposes of electric lighting.

The electric lighting station for Lowestoft will soon be under construction—the Town Council having last Tuesday accepted a contract for carrying out the work. It is hoped to get the light installed before next holiday season.

The Radcliffe District Council have received a communication from the Local Government Board, sanctioning the borrowing of £1100 for the purchase of land and £14,900 for other works in connection with the electric lighting scheme.

The Wigan Town Council have recently accepted a tender for the buildings required for their electric lighting installation. It amounted to £15,799, which one of the members stated was £8000 more than it was proposed to pay five years ago when the matter was under consideration.

The Liversedge District Council have decided to apply to the Board of Trade for a Provisional Order authorizing them to supply electrical energy in the district. The application will conflict with that of Cleckheaton to the extent that the Cleckheaton gas supply area includes territory within the Liversedge township.

The Swansea Tramways and Electric Lighting Committee have accepted a tender, amounting to £17,242, for the building of their generating station. The Engineer's estimate was £14,752; and he attributes the difference to the rise in the price of material since. Offers are now to be invited for the plant to equip the station.

Two tenders for extensions at the electric light works were accepted by the Carlisle Town Council last Tuesday. One was for the supply of boilers at a cost of £1690; and the other was for engines, dynamos, &c., and amounted to £5710. The successful contractors in the latter case were Messrs. D. Bruce Peebles and Co., of Edinburgh.

The works of the Northallerton Electric Light Company were formally opened last Friday; and the town, we are informed, was "brilliantly illuminated by twelve arc lamps of 2000-candle power each." Orders, it is stated, have been received for 600 lights in private houses and shops. The cable, of which there is 5 miles, is carried overhead; and a novel feature is that it consists of aluminium instead of copper. It is believed that this is the first time aluminium has been used for such a purpose in England; and it has been adopted on account of the high price of copper (£88 per ton)—aluminium being 20 per cent. cheaper.

As mentioned in the "JOURNAL" last week, the Ventnor District Council have before them a scheme for the electric lighting of the town by arc and incandescent lamps at a cost of £707 10s. As this is about £200 more than the amount expended last year on the public lighting, some of the members of the Council are rather alarmed; and they have asked the Electric Lighting Company for an amended estimate for incandescent lamps only. There was scarcely any need to do this, as, if economical and efficient lighting were desired for this charming watering-place, the Council might have seen what the Gas and Water Company could do. But the members seem to be too dazzled by the electric light to be able to look at the Company's offer. They are willing to put up 120 new Welsbach lights of 75-candle power, including the cost of lighting, maintenance, &c., for £378; or 100 75-candle and 20 100-candle lamps for £387. The Electric Lighting Company's figures are: 32 arc lamps, at £15, £480; 91 incandescents, at £2 10s., £227 10s.—total, £707 10s. This difference should surely commend itself to economical councillors.

A Local Government Board inquiry was held at Cheltenham last Tuesday with respect to the application of the Town Council for sanction to borrow £16,600 for the purposes of further extension of the electric light. The Mayor, as Chairman of the Lighting Committee, stated that the deficiency in 1895-6 on the working expenses was £621 15s. 1d. In 1896-7 there was a surplus of £54; in 1897-8 it was £1262; and in

1898-9 it increased to £2148. The June quarter of last year showed an income of £910; and in the corresponding quarter this year it amounted to £1380. The number of customers taking the light had increased during the past year from 260 to 327; and the current now supplied to private consumers was equal to 20,885 8-candle power lamps. As to street lighting, there were at present 197 arc lamps in use; and 100 more were ordered. At the present rate of progress, he anticipated that during the ensuing year the undertaking would pay all charges upon it and make a profit. The average cost of the current to private consumers was 5d. per unit. There was no opposition.

Contradictory statements were made at last Tuesday's meeting of the Bristol Town Council regarding the relative cost of gas and electricity. They arose out of a complaint by Alderman Fox that the Libraries Committee were deterred from using the electric light by reason of its cost; and Mr. Smith supplemented this with the assertion that they found the light two-and-a-half times as costly as gas. Mr. Hughes, on the other hand, said that his experience was very different from the common; and yet Mr. Barker followed him with a plea for a reduction in price for the supply of current to the Museum. According to Mr. Parsons, the people of Bedminster were much disappointed after the cleaning of the library to find gas still there. He used the electric light, and found it nothing like two-and-a-half times dearer than gas. Against this, Mr. Smith stated that the figures for St. Philip's Library were £110 for the electric light; and at Redland, which was three-fifths the size, gas cost only £17 a year. Mr. Lloyd, for some reason not quite clear, characterized this comparison as one deserving the condemnation of every straightforward man, and as calculated to injure the only successful monopoly the Corporation had. Mr. Spofforth held that Mr. Smith's statement was perfectly justified. Upon this, Mr. Pearson promised to consider whether the Libraries and the Museum could be put on the same terms as the public lighting. As to the cost of electric lighting, however, being double that of gas, candle-power for candle-power, it was not so, unless there was absolute waste. His own last electricity bill was less than the former gas bill; and he had more lamps than he ever had gas-lights. If the members of the Electrical Committee are not specially favoured, what is the explanation of these opposite experiences?

The Bristol Town Council, on the advice of the Electrical Committee, have recommended that about 9 acres of land in St. Philip's Marsh be purchased for £14,492, from the Avonbank Estate Company, for the purposes of another electric light station. When the matter was before the Council, Mr. Pearson, the Chairman of the Committee, sought to show that the proposed expenditure was justified by the fairly successful conduct of the undertaking hitherto. The Committee, he said, began in August, 1893; and besides £2400 received from the rates at the outset, they had £11,400 subsidy from the rates in the first three years. They paid back £7200 of the original loan from the rates. In 1894, they had about 16,000 lamps connected; in March, 1899, 68,000; and now the number was 74,484—an increase entirely out of proportion to what the Committee at first anticipated. In the first year 300,000 units of electricity were sold; and last year 1,362,000 units—an increase of rather more than a million units in the five years. The revenue had grown from £6624 to £26,233; and the cost of production had decreased from 4¼d. to not quite 2¼d. The first two years they had a loss; but last year they carried to the credit of the net revenue account £12,630. It had been said that it was improper to reckon profits until they had paid the interest and sinking fund. In his opinion that was wrong. No company refused to reckon their profits until they had paid the debentures and the interest on share capital. The electrical undertaking had shown a profit averaging rather more than 7½ per cent. on the total capital invested; and this had been done notwithstanding the fact that the Committee reduced the charge for private lighting by 15 per cent., and the public lighting by 30 per cent. from January. The lamps connected increased by 6600 in 1895, 11,700 in 1896, 10,700 in 1897, 10,800 in 1898, and 18,893 in 1899; and in the five months of this year from March, they had increased by almost 6000, which was at the rate of 1000 a month in the worst part of the year. So long as the Council sanctioned the present policy of devoting the profits to reductions in price, so long would the demand continue to increase. Of course, the Council could change that policy, and ask for a payment in relief of the rates; but for many years to come, he should advise the continuance of this policy. The Marsh site which it was proposed to purchase would afford space for plant to supply 800,000 lamps—rather more, he believed, than the gas-lights of the city, and more than ten times the present output of electricity.

Lewes Gas Company.—The half-yearly meeting of this Company was held last Thursday. The revenue account showed a profit of £1846. After providing for interest on mortgages, &c., the balance of net revenue was £2762. The Directors recommended a dividend at the rate of 5 per cent. upon the consolidated original capital stock, at the rate of 3½ per cent. upon the £4000 additional capital stock, and, in addition, the payment to the holders of the consolidated original capital stock of 1 per cent. in part payment of the arrears due to them. These dividends would amount to £1694, and leave £1067 to be carried forward. The Directors also announced that they had appointed Mr. M. S. Blaker to fill the vacancy on the Board caused by the death of their late colleague, Mr. Edward Hillman. The Chairman (Mr. J. Broad), in moving the adoption of the report, said it was very gratifying to the Directors to produce such a satisfactory balance-sheet. It would be noticed that there had been a general increase in the receipts; and although there had been a small additional expenditure, there was a good margin of profit. He was glad to find that in the past five years the receipts for gas had increased by £1730, and that the rental of meters had advanced by £87. This was, he considered, extremely satisfactory, especially seeing that the increase had been produced with but very little extra capital. The capital had been increased by £4000; but this included the amount for the purchase of new property. The addition to capital was therefore very trifling when they came to look at the increase of £1817 in receipts in five years. At the same time, the works were never in a better position than at the present time. They had also been favoured with a very good contract for coal, which had helped them monetarily; and he was glad to say that the contract would carry them well into next year. The motion was adopted; and the dividends proposed were also agreed to.

THE LONDON COUNTY COUNCIL AND THE WATER QUESTION.

Correspondence with the Local Government Board.

It may be remembered that when the subject of the condition of the Thames and Lea was under discussion at the London County Council just before the rising of that body for the recess, it was stated that a communication had been sent to the Local Government Board on the question. The letter, which was addressed to the Secretary, was dated the 18th of July, and signed by Mr. C. J. Stewart, the Secretary of the Council. It was as follows:—

Sir,—The Water Committee of this Council have had their attention directed to the present abnormal condition of the rivers from which London derives the principal portion of its water supply. A statement has been presented to the Committee by the Chief Engineer of the Council, having reference to the daily flow of the Thames and the Lea, from which it appears, *inter alia*, that: (1) The average flow of the Thames, inclusive of the water taken by the Companies, as calculated by the quantity coming over Teddington Weir in June, taken over a period of sixteen years, from 1883 to 1898, was 682,800,000 gallons per day. (2) The average flow in June, 1898, was 549,000,000 gallons per day. (3) The average flow in June, 1899, was 368,700,000 gallons per day.

These figures show that the natural flow in June of the present year has amounted to only 54 per cent. of the average flow at the same period of the year during the last sixteen years, and is far below the flow of 1898, which year was one of excessive dryness. Also it appears that the amount of water flowing daily over Teddington Weir, after deducting the quantities abstracted by the Companies was: In June, 1898, 429,000,000 gallons; in June, 1899, 236,900,000 gallons. In other words, the actual flow this year was only 33 per cent. of that of June, 1898. Further, it is to be noticed that on the 12th of June it fell as low as 158,300,000 gallons. With respect to the draught of water by the Metropolitan Water Companies, it appears that the average daily quantity drawn was: In June, 1898, 120,000,000 gallons; in June, 1899, 131,800,000 gallons. These figures show an increased draught of nearly 12 million gallons a day, although probably a portion of this excess is due, not to immediate consumption, but to the requirements of the East London Water Company for the purpose of filling up their reservoirs. As, doubtless the facts upon this point are in the possession of the Local Government Board, I am instructed to say that the Council would esteem it a favour to be furnished by the Board with the figures showing the amounts actually delivered to the consumers in June of this year.

With regard to the Lea, the Water Committee understand that the amount of water passing down that river in June, 1899, was insufficient of itself to supply the quantity required by the New River and East London Companies by at least 9 million gallons a day; and that, therefore, the East London Company are depending already upon the water stored in their reservoirs, and the supplies which they can obtain from the Thames through the mains of other Companies. These figures are, however, based only upon knowledge of the flow at Feilde's Weir, and in ignorance as to what quantity of water the New River Company have during June, 1899, been passing down to the intakes of the East London Company; and the Water Committee will be grateful if information can be vouchsafed on this point also, in order that they may form a reliable opinion as to the real position of the Metropolitan Water Supply at the present juncture.

The Committee are advised by their Engineer that a study of the rainfall of past years during the months of July, August, September, and October, and of the proportion lost by evaporation during these months, points to the conclusion that, unless the rainfall in the immediate future very much exceeds the average, the Thames cannot recover even its normal summer flow. It is not unlikely that the flow between the present date and the end of September will be less than that of 1898; and in this case the draught upon the Thames that will be necessary in order to keep London fully supplied will absorb the greater portion of the river. It is evident that a very serious question may arise within the next few weeks as to the best measures to be taken for distributing to the Metropolis the water that will be available. The Water Committee are glad to think that, so far as East London is concerned, the Royal Commission upon London Water Supply have in their interim report expressed themselves satisfied by the evidence of the Water Companies that the East London Company will, during the months of July, August, September, and October, 1899, be able, with the assistance of other Companies, to maintain the full supply required by their consumers; and as the powers necessary for enabling Companies to afford each other assistance have been obtained from Parliament, the Local Government Board have doubtless already taken all the steps that are advisable to secure all parts of the Metropolis against any possible danger. At the same time the Committee would draw attention to the fact that the present state of the Rivers Thames and Lea is causing considerable anxiety in many quarters of London, and suggests that some assurance to the public from the responsible officers of the Government that all proper steps have been taken to enable the different Companies to assist one another in case of need will be of great value at the present moment. With this view, I am instructed to ask most respectfully whether the Board will so far favour the Council as to inform it what the views of the Board are as to the prospects of the water supply being sufficient during the ensuing four months, and how far the communications between the works of the Companies are now capable of meeting the needs of the present year.

Mr. Stewart asked that a reply to his letter might be sent by the following Friday; but the answer of the Board is dated the 29th of August. It is signed by Mr. J. Lithiby, and is as follows:—

Sir,—I am directed by the Local Government Board to advert to your letter relative to the present condition of the rivers from which London derives the principal portion of its water supply.

With regard to the request of the Water Committee of the County Council to be furnished with figures showing the amount actually delivered to the water consumers in June of this year, and the quantity of water passed down during the month to the intakes of the East London Company, I am directed to enclose a copy of General Scott's report for June, in which will be found the particulars asked for.

With respect to the supply of water from the Thames, the Board have been in communication with the Thames Conservancy Board, and they enclose a copy of a memorandum as to the flow of the river which has been made by the Engineer to the Conservancy Board [Mr. C. J. More].

In your letter you assume that "as the powers necessary for enabling Companies to afford each other assistance have been obtained from Parliament, the Local Government Board have doubtless taken all the steps that are advisable to secure all parts of the Metropolis against any possible danger;" and you ask for an assurance "that all proper steps have been taken to enable the different Companies to assist one another in case of need."

So far as the needs of the present year are dependent upon communications between the Companies, your assumption is correct; and the Board have taken such steps as appear to them to be necessary and possible, since the passing of the Act, to ensure a proper distribution of the water supply.

As regards East London, the Board direct me to enclose a copy of an answer given by the President to a recent question in the House of Commons on the subject. It will be observed that the President sees no reason to doubt that the measures taken will be effectual to meet the needs of East London during the present summer, so far as they depend on communications with the mains of other Companies.

The County Council are aware that schemes for the intercommunication of all the Companies on a larger scale were submitted to the Royal Commission. But, even if it had been thought desirable to adopt them, they could not have been completed during the present year; and the Government were urged, you will remember, on behalf of the County Council in the House of Commons, to limit their requirements, in the first instance at all events, to the provisions necessary to secure East London against the recurrence of water famine.

You further express the opinion (*a*) that the flow of the Thames between the present date and the end of September will not unlikely be less than that of 1898, and in that case the draught upon the river that will be necessary in order to keep London fully supplied will absorb the greater portion of the water; and (*b*) that a serious question may arise in the next few weeks as to the best measures to be taken for distributing to the Metropolis the water that will be available.

This is apparently a considerable departure from the views of the County Council as stated by Mr. Dickinson, Chairman of the Water Committee of the Council, when opposing the Staines Reservoirs Bill in 1896—viz., that "if we (*sc.*, the County Council) were not sure that the consumers were safe for seven years, we should not be objecting to this Bill." But the Board agree with you to this extent—that it seems to them to be clear, from the experience of the Thames and the Lea during 1898 and the months of May, June, and July this year, that the future security of the water supply of the Metropolis and the adjoining districts depends on the construction of reservoirs for the storage of surplus water; and the necessity for this cannot be affected by any of the questions before the Royal Commission on Water Supply now sitting.

Finally, you inquire "what the views of the Board are as to the prospects of the water supply being sufficient during the ensuing four months, and how far the communications between the works of the several Companies are now capable of meeting the needs of the present year."

If the Staines reservoirs had been completed and were in operation at the present time, the Board are of opinion that the Metropolis would be secured against any difficulties which could conceivably occur within the next few months. But in the absence of these reservoirs, the sufficiency of the supply depends mainly upon the condition of the Thames; and the condition of the Thames depends again upon the prolongation of the drought. As to how long the drought is likely to continue the Board are not more competent to form an opinion than the County Council or anyone else. It is a matter of prophecy on which they must decline to pronounce. But they are strongly of opinion that the question of additional storage power in the valley of the Thames and of the Lea is becoming of more and more importance every day for the security of the water supply of the Metropolis in the future.

The Board are aware that it has been the policy of the London County Council to oppose the Bills brought before Parliament by the Water Companies for powers to construct storage works on the Thames and the Lea; and again last session, I may remind you, they were successful in compassing the defeat of a Bill for the construction of reservoirs with a capacity of 5000 million gallons, which had passed the House of Commons, and was rejected by a Committee of the House of Lords after strenuous opposition by the Council. The Board have always regretted the opposition which proposals for this purpose have encountered, because, in their opinion, the supply of water necessary for the Metropolis must be obtained from these sources during the next fourteen or fifteen years in any case; and failure to obtain the necessary authority from Parliament might result in scarcity of water affecting the whole of the population of London and the suburbs within the districts of the Water Companies.

[ENCLOSURES.]

Memorandum of the Engineer to the Thames Conservancy Board on the Flow of the River Thames, Aug. 10, 1899.

The gaugings at Teddington Weir taken with the returns made by the Metropolitan Water Companies show that the long-continued drought has considerably reduced the flow of the Thames; but there is not at present any cause for anxiety that the flow of the river will not be sufficient to meet the requirements of the Water Companies.

The summer flow of the Thames is largely dependent on springs fed by the winter rainfall; and the very low state of the Thames during July, August, and September of last year was as much due to the dryness of the preceding winter months as to the small amount of summer rainfall. The amount of rainfall measured in the Thames basin for the six months October, 1897, to March, 1898, only amounted to 9·01 inches, against 14·76 inches, the average for the seventeen preceding winters—showing a deficiency of 39 per cent.; while during the same months of the winter 1898-9 the amount recorded was 16·45 inches, or 11·5 per cent. above the average. The natural flow of the Thames during these months was 35·4 per cent. of the rainfall during the winter of 1897-8, against 33·8 per cent. for the winter of 1898-9; and as the evaporation would be about the same in both periods, it follows that a much greater quantity of water was absorbed by percolation during last winter than during the winter preceding it. Thus we may expect that the springs feeding the Thames will yield a larger amount this summer than in the summer of 1898.

In comparing the flow of the Thames in June, 1899, with that of June, 1898, it must be noted that in the latter month the effect of the heavy rains which fell towards the end of May (during which month 3·05 inches was recorded in the Thames Valley) had not passed away; and any comparison with the average for a long series of years is apt to mislead, unless the years of extraordinary flow are excluded.

The unusually large quantity of water taken by the Water Companies is, no doubt, due to their desire to keep their storage reservoirs full. This is a very wise precaution, although it is not considered that the flow of the Thames is likely to fall short of their requirements. It must, however, be remembered that, though the Water Companies may not suffer from any want of water for their supply, the reduced volume passing over Teddington Weir may, if continued for a long period, be prejudicial to the navigation of the river, particularly in the reaches below Richmond.

Question of Mr. Pickersgill in the House of Commons on Friday, July 28, 1899, and Mr. Chaplin's Reply.

Mr. Pickersgill to ask the President of the Local Government Board what steps, if any, he has taken under the powers conferred on the Board by the Metropolis Water Act, 1899, to render the supplies of the different Companies mutually available in case of emergency, and especially to protect the East-end of London against the sufferings and inconvenience experienced in former years.

Mr. Chaplin: Communications have been effected between the mains of the Southwark and Vauxhall and the East London Companies, and between the Grand Junction, the West Middlesex, and the New River Companies. The New River Company is also in communication with the East London Company; and the Kent Company is laying a main to communicate with the Southwark and Vauxhall Company. The East London Company has since the middle of June been receiving water from the New River and the Southwark and Vauxhall Companies. According to our latest information, there was considerably over 1000 million gallons in the reservoirs of the East London Company; and I see no reason to doubt that the measures taken will be effectual to meet the needs of East London during the present summer.

THE CONGRESS OF THE SANITARY INSTITUTE.

Dr. Percy Frankland, F.R.S., on the Science of Bacteriology.

In the "JOURNAL" for the 5th inst., reference was made to the Inaugural Address of Sir W. H. Preece at the recent congress of the Sanitary Institute at Southampton; and in another column to-day we reproduce some observations made by Dr. Percy Frankland, F.R.S., in the course of his address to the Section of Physics, Chemistry, and Biology on the report of the Water-Gas Committee. Among other matters touched upon by him was the science of bacteriology, of which, as our readers are aware, he has made a special study; and we give below an abstract of this part of the address.

In introducing this subject, Dr. Frankland remarked that the science of bacteriology was now so firmly established in public estimation, and its utility to man so fully recognized, that no apology was needed for bringing it forward; nor did the mention of it now cause the smile of contempt which was provoked some ten or fifteen years ago. However, its reputation has been assured, though some of the expectations then entertained in regard to it had proved illusory. He would take as an example the application of bacteriology to the hygienic aspects of water supply. Many enthusiasts for the new science thought that a revolution in the methods of dealing with the problems presenting themselves in connection with water supply was at hand; and that the guarded opinion of the chemist, recommending or condemning the use of certain water on a review of all the circumstances connected with it, would give place to the authoritative pronouncements of the bacteriologist, who would be able to declare that one water was absolutely safe because it was free from all pathogenic bacteria, that another would cause cholera, and a third produce typhoid. Far from the introduction of bacteriological methods having proved to be the dawn of such a new era as was anticipated by the sanguine and misguided enthusiasts in question, time and the more careful study of micro-organisms had revealed the insuperable difficulties in the way of arriving at any such clean-cut and definite conclusions. Indeed, the detection of specific pathogenic bacteria in drinking water was now known to be almost beyond the range of practical politics; and the search for such bacteria was generally only carried on in deference to the special request of the layman, the uninitiated, or the hopelessly ignorant. It could not be repeated often enough that any feeling of security which might be gathered from an unsuccessful search for pathogenic bacteria was wholly illusory, and in the highest degree dangerous. However, notwithstanding these misconceptions, which still lingered long in places, the real value of bacteriology to water hygiene was now generally recognized.

Dr. Frankland went on to point out that by far the most important service rendered by bacteriology in connection with water supply is the means it affords of controlling the efficiency of filtration and other purification processes. Such control is now systematically and regularly exercised at a number of the more important water-works where filtration is carried on. The result is a highly beneficial one, as the slightest irregularity or defect in the process of filtration is at once laid bare, and brought to the notice of the engineer, who has now a standard of efficiency to aim at, and is stimulated and encouraged in his work, whereas the absence of such stimulus must have been in the highest degree disheartening. The bacterial purity of well waters can also be satisfactorily controlled—any departure from their normal character being at once detected. Moreover, the great bacterial improvement which surface waters undergo by storage and sedimentation has been ascertained, and has led to the further extension of this important means of purification. The water expert is now being guided, in the formation of his opinion, by the qualitative nature of the bacteria which he discovers.

Summing up his remarks on this section of the address, Dr. Frankland said: The bacteriological methods which some of us welcomed fifteen years ago as invaluable adjuncts to the chemical methods of water examination have brought forth abundant fruit, and have been of the greatest assistance in that work of making provision against water-borne disease which was first inaugurated on scientific lines by those classical

labours which are recorded in the Sixth Report of the Rivers Pollution Commission in 1874, and which form a landmark in the hygienic annals of the present century.

Dr. Frankland then proceeded to deal with the bacterial purification of sewage, and said that practically the only purification of sewage which had ever been effected in the past, or ever took place at present, was entirely due to bacterial action. In this regard, as in the case of water hygiene, it was to the work of the Rivers Pollution Commissioners of thirty years ago that one must turn, not only for the first indications of how sewage purification should be carried out on scientific lines, but for the most complete instructions as to the manner in which the real purification of sewage must be conducted. The classical investigations of that Commission showed long ago that the purification of sewage by chemical means alone was an *ignis fatuus* and a chimera; but that by distributing sewage over porous materials, which were alternately bathed with the sewage and atmospheric air, a degree of purification was obtainable, which a generation of eager investigators had been unable to improve upon. What was new was the invention of methods by which the micro-organisms were enabled to do their work more effectually.

The Control of Watershed Areas.

In the Section of Engineering and Architecture, the President (Mr. J. Lemon, M.Inst.C.E., &c.), in his address, referred to the question of water supply, and said that one of his predecessors in the chair—Mr. Lewis Angel—had stated two years ago that there was then sufficient water for twenty-five times the population. The raising of the standard of purity, however, and the increased number of people, had led to a scramble for better sources of supply. Birmingham had gone to Wales; and the London County Council wished to follow their example. How far this race from one portion of the kingdom to another on the part of the wealthy corporations should be permitted, was a matter of serious consideration by Parliament. It might be desirous to allocate the areas of supply to certain districts, so that it would not become a question of "first come first served" and the longest purse. This subject was dealt with in a paper read by Major Lamorock Flower, Sanitary Engineer to the Lea Conservancy Board, at a conference of municipal representatives. He said he did not propose the creation of any new public body, but rather to raise the question as to how existing authorities might be utilized in amelioration of the polluted state of the rivers—a condition which had not inaptly been styled "a national evil." In this direction the author made a suggestion at the conference on the Health and Sewage of Towns, which was called by the Society of Arts at the instance of H.R.H. the Prince of Wales, in May, 1876, in these words: "If we are to have our rivers purified, the whole country should be mapped out into districts, each under a competent sanitary officer, who should have large powers, under Conservancy Boards formed to legalize his acts." As President of the conference on River Pollution held by the Sanitary Institute at the congress at Leeds in 1897, he again brought forward the idea. It was thought that the establishment of County Councils would provide the necessary authority. But they had plenty of work to do in other directions; and river pollution was likely to go on practically unchecked. The Local Government Board were already overworked. The Lea Conservators were the first public body entrusted with the care of a whole watershed area; and the author was the first officer in the kingdom to whom was entrusted the duty of supervising it. His experience from 1871 as to the value of individual action was the key-note of his suggestion in 1876. He has no reason in 1899 to change his opinion. Mr. R. E. Middleton, in his paper on "The Desirability of Making Watershed Areas and Sanitary Districts Coterminous," read before the Institute last year, said: "Every authority is in conflict with its neighbour—conflict in interest, if not in fact—and litigation and disagreement are too frequently the result." Such an eminently unsatisfactory state of affairs ought not to exist. It appeared to the author that the appointment of a special officer to take charge of each watershed which was contained within the jurisdiction of several County Councils, with a reference to a Joint Committee consisting of members out of each Council, would solve the difficulty. "The Times," writing on the subject of the Pollution of Water Supplies, supported the author's ideas. In 1892, the Mersey and Irwell Act was passed. In 1894, the Thames Conservators' jurisdiction was extended to the whole watershed area, with undeniably good results. At the beginning of 1898, as many as 78 towns or villages, with an aggregate population of over 180,000, polluted the river or its tributaries. Mr. Groves, the Analyst to the Conservators, reported that, owing to the action taken by them, the amount of organic impurity in the water immediately above the Companies' intakes was now only about two-thirds of what it was before the passing of the Act. It was not to be supposed that results such as he had quoted could be brought about without some heart-burnings, but the fact remained. The River Severn flowed through twelve counties, and had many different authorities. The Thames, which was managed by a Committee out of the whole body of Conservators, seemed to furnish a model for imitation. One of the chief objects of Sir Francis Powell's Rivers Pollution Bill was the promotion of conjoint Councils and River Boards deputed by Local Authorities to take under control the streams, rivers, &c., within their respective watershed areas. In dealing with this question, the author said he desired to point out distinctly that he referred solely to jurisdiction over the pollution of rivers. The following resolution was passed: "That in the opinion of this meeting the desirability of establishing Joint Committees for watershed areas is necessary; and they recommend to the Council of the Sanitary Institute that they should further the objects proposed in Major Flower's paper by action in the proper quarter."

The Storage of Flood Water.

The above subject was dealt with in the following paper, read by Professor Henry Robinson, M.Inst.C.E., in the Section of Engineering and Architecture:—

The better conservation of the rainfall of this country is a national question, and demands careful consideration. Population increases, but the water available for them does not; and every year there arises a struggle for watersheds from which to obtain the supply for our towns, while the villages too often depend upon shallow wells liable to pollution. An ideal state of things would be for the whole country to be mapped out into watershed districts under a Department of State. The rivers and watersheds could then be utilized on some definite system to ensure the conservation of the water, and avoid the appropriation of important gathering-grounds for comparatively small purposes.

There is a grave need of well-considered and comprehensive treatment of watersheds, so that flood waters are stored; thus rendering the flow of the rivers more equable, and the excess water, which now does mischief by causing floods, is available for domestic supply, for irrigation, for improving navigation (either in river or in canal systems), for power purposes, improving the working of existing mills, and in founding new industries. An initial difficulty is the cost of constructing storage works. The owners of the high-level lands may object to pay for the construction of reservoirs which would both prevent the flooding of low-lying property and provide water to be employed elsewhere. They might even claim to reap direct financial benefit; being the possessors of table-lands receiving rainfall which has so great a value in view of its admitting of conservation for national purposes. The interests of riparian proprietors and property-owners being divergent, the solution of the problem must be difficult.

In legislating to secure the storage of flood waters, it would be necessary to constitute an authority free from the sphere of local influence and conflicting interests. Where Conservancy Boards have been formed, the object of their establishment has been chiefly either to maintain the river for purposes of navigation or to prevent its pollution. In Ireland, legislation has taken the shape of forming drainage districts to free from floods the lands which previously were subject to them; but the numbers representing the lands liable to floods were often small compared with those whose lands were above this; and so a deadlock arose. In Holland, Boards have been in existence for a long time. The local arrangements for dealing with each area in regard to controlling the flow of water were settled by Executive Boards, with the right of appeal to a central authority. The right solution of the question of the future supply of water to London will be found in storing the vast volumes which pass off the watersheds of tributaries of the Thames; as natural valleys afford admirable storage for water which now runs to waste.

Recourse is frequently had to underground water, by establishing pumping-stations. This source of supply, however, has been in several recent cases hampered by conditions involving compensation to those whose wells might be injuriously affected. Although the law does not give any property in underground water, owing to the inability to identify it (the well-known case of *Chasemore v. Richards* governs this question), there can be no doubt that the law operates most inequitably. Anyone can buy a plot of land, sink a shaft, and pump water from beneath the surface, without being under any obligation to compensate those whose supplies are affected. Where the direction of flow of underground water enables samples to be taken to which lithia has been added, the water can be identified, the peculiar band produced in the spectroscope by lithia being recognizable.

It was once thought that the admission of flood waters into storage reservoirs would permanently affect the purity of the water thus impounded, on the assumption that the causes of pollution would tend to increase. Hence the treatment of watersheds and the construction of reservoirs were based on the principle of excluding large volumes of water which have been sent to waste. Many years ago, I stated: "It has often been contended that organisms injurious to health, derived from sewage decomposition, continue to live after their discharge into a river, and are practically incapable of being destroyed. I think this view has been overstrained. Is it not a reasonable assumption that these organisms may be quite incapable of existing when favouring conditions cease?" The recent inquiry in regard to London water led to the expression of opinion that "when pathogenic bacteria pass into the outer air or water, they are in an unnatural medium, in which they can only maintain their existence and power of multiplication for a limited period, during which they undergo more or less rapid attenuation or loss of virulence, and become generally weakened."

The influences which are at work to destroy, or render inert, the undesirable matters in such waters are well recognized. The lower temperature of rivers is unfavourable to the cultivation of germs, which originate in media of high temperatures. Harmless bacteria appear to deprive the hurtful ones of conditions necessary to their propagation, and so lead to their destruction. Minute organisms which thrive and multiply on organic matters act as scavengers. Aquatic plants which liberate oxygen in the presence of light, aid in effecting the purification of waters that are not pure. In a storage reservoir receiving flood waters, all suspended matters carry down and help to destroy hurtful matters. It has been proved that a river water which has had some polluting matter in it has become "inoculated," and is less capable of the cultivation of organisms than pure moorland waters (so often alleged to be the only true source of supply), which are very favourable to their cultivation and propagation. This has a very important bearing on the question of storing flood waters.

The mean or average rainfall, and the fluctuation of rainfall, have to be studied, and it seldom happens that records are available over long periods; and if records over only short periods are relied on, great errors may arise. It has been ascertained that in stations where the mean was under 20 inches the fluctuation was rather larger than in ordinary cases. Summarizing the averages of a great many stations over long periods in percentages of the mean annual rainfall, the following table gives the result:—

	Wettest.	Driest.
A single year's fall.	1·51 ..	0·60
Average fall of two consecutive dry years . .	1·35 ..	0·69
" " three " " . .	1·27 ..	0·75

At Greenwich, where the mean annual rainfall is 25·04 inches, the ratio to the mean is as follows: Maximum, 1·45; minimum, 0·67; average for three dry years, 0·81.

We must aim at the retention in reservoirs of the water coming off gathering-grounds when rainfalls of from 2 to 6 inches in 24 hours occur and the smaller falls over longer periods, during which the bulk is passing to waste. Such floods have been found to yield volumes ranging from 34 (Clyde) to about 500 (Derwent) cubic feet per second per square mile. To store flood water for the benefit of the community is a task which deserves prominent consideration at this congress; and I trust my brief communication may serve to advance this important matter.

THE COUNTY COUNCILS ASSOCIATION AND THE LAWS AFFECTING SOURCES OF WATER.

At the recent Annual Meeting of the County Councils Association, attention was drawn to the present condition of the law affecting sources of water which are or may become necessary for local consumption, and the advisability of conferring powers on Local Authorities in regard thereto. The Executive Council of the Association, on the question being referred to them, appointed a Committee to consider and report on this subject. Lord Belper, the Chairman of the Nottingham County Council, was appointed to preside; and the other members of the Committee were Sir J. F. Lennard, Bart., Mr. E. J. Halsey, Mr. T. F. Halsey, and Mr. W. J. Freer, of the Kent, Surrey, Herts, and Leicestershire County Councils respectively.

The Association have now issued a circular-letter addressed to the Clerks of County Councils, County Boroughs, and all Urban and Rural District Authorities in England and Wales, pointing out the necessity of immediate steps being taken to protect the rights of localities in the natural water supplies existing within their areas. Attention is called to the fact that, owing to the action of the Association, the Standing Orders of both Houses of Parliament have been assimilated, and County Councils can now appear before Committees of either House upon all Water Bills affecting their interests, or the interests of Local Authorities within the Administrative County. That they can do so with success was proved during the last session of Parliament, in the matter of the Derwent Valley Water Act.

The letter proceeds: The difficulties that exist in the present state of the law, as it affects private rights in water, appear to be of the gravest character. The following concrete case will illustrate this: Certain urban districts are supplied by a local water company. Another water company, desiring to add to its powers of supplying an important centre, purchases land outside its own area, but within the limits of the urban districts, proposes to sink a well thereon, and arranges with a railway company to carry the main along the railway-line into its own distributing area. It is not obliged to obtain consent either to borrow money for the work or to open up roads. In the opinion of Counsel, the water company and the railway company are both acting within their rights, and cannot be stopped, although the district authorities, and the county council desirous of assisting them, are fully persuaded that the action of the intruding company will result in the district being deprived of the water supply which exists within its own area, and is necessary for the use of the inhabitants and for their health. Attention has been drawn to another way in which the water supply is threatened in some districts, and which is becoming of very great importance. It appears that hitherto it has been the practice of colliery companies to exclude from the pits the water contained in the permeable strata through which the shaft passes, by lining the shaft with iron tubbing. During the sinking of a new shaft, it has been necessary to keep down the water by pumping; and this has in many cases dried the neighbouring wells for a time. But when the tubbing was placed in position, the pumping was stopped and the water in the soil returned to its normal level. It seems, however, that at collieries now being opened in certain parts of the country, the plan of tubbing is being given up; and it is proposed instead to pump in perpetuity—a separate shaft being in some cases sunk for this purpose only. The Association are informed that at the present moment, in a new pit in a certain part of England, a shaft is being sunk for pumping purposes only; and though the coal is not nearly reached as yet, millions of gallons of water are being pumped to waste every day. Four miles from this pit some strong springs have ceased to flow; and this is attributed to the pumping operations of the colliery proprietors. The instances given above point to two only of the many ways in which a local water supply may be seriously affected; and, as the law at present stands, it does not appear that local authorities have any power to protect the interests of their ratepayers.

As the Committee of the Association propose to consider whether it is possible, by legislation or otherwise, to invest local authorities with some such power as that mentioned above, or to devise some other remedy for the "admitted evil," the Committee invite suggestions or any information bearing upon the subject.

THE OPERATION OF WATER-FILTERS IN GERMANY.

The regulations for the purification of surface water by filtration through sand when there is danger of cholera, which were prepared by the German Imperial Board of Health some years ago, have been revised by that body, with the assistance of a number of eminent specialists in sanitation and filtration, and are reviewed in a recent number of the "Gesundheits-Ingenieur." It was decided at the outset of the conference that the regulations might well be followed at times when cholera was not to be feared; and this consideration probably had weight in determining the form in which the sections now appear. The regulations are issued from the Bureau of the Interior of the Office of the Imperial Chancellor; and the following translation of them appeared in a recent number of the "Engineering Record":—

1.—In judging the quality of a filtered surface water, attention is to be paid to the following points: (*a*) The operation of the filter is to be regarded as satisfactory if the number of bacteria in the effluent does not exceed that limit which experiment has shown to be attainable by good sand filtration at the water-works in question. A satisfactory effluent shall, as a rule, not contain more than about 100 bacteria per cubic centimetre when it leaves the filter. (*b*) The filtrate must be as clear as possible, and must not be inferior in colour, taste, temperature, and chemical character to the water before filtration.

2.—In order to control a water-works continuously in its bacteriological relations, it is advisable to examine the effluent of each filter daily where the conditions permit. Such a daily examination is particularly important after the construction of a new filter until it assumes its regular working conditions; whenever a filter is put in operation after cleaning, and for at least two days after that time, until the effluent has a satisfactory character; after the filtration head becomes more than two-thirds of the maximum for the works in question; when the filtration head suddenly decreases; during all unusual conditions, especially at times of high water.

3.—In order to be able to conduct bacteriological investigations according to section 1 (*a*), the effluent of each filter must be accessible, so that samples can be taken at any desired time.

4.—In order to assure a uniform system of bacteriological investigations, the method given in the Appendix is recommended for general use.

5.—The persons entrusted with the conduct of the bacteriological investigations must furnish proof that they possess the qualifications necessary for the work. They should belong to the official operating staff itself whenever possible.

6.—If a filter furnishes water which does not meet the hygienic requirements, it is to be cut out of service, provided the cause of the deficient character has not already been removed during the course of the bacteriological investigations. In case a filter furnishes an unsatisfactory effluent oftener than occasionally, it is to be placed out of service, and the defects sought out and remedied.

7.—In order to be able to waste poor water which does not meet the requirements, each filter must be arranged so that it can be cut off from the filtered-water mains, and the effluent allowed to flow away. This waste is to take place regularly, so far as the details of management permit, immediately after the complete cleaning of the filter, and after completely renewing the bed of sand. The superintendent in charge must determine from his experience with the continuous bacteriological investigations whether a waste of the effluent is necessary in each individual case after the completion of this cleaning or renewal, and the length of time which must elapse before the effluent attains the required degree of purity.

8.—It is necessary for satisfactory sand filtration that the surface of the filters have ample dimensions, and provide sufficient reserve to assure the velocity of filtration suitable for the local conditions and the character of the raw water.

9.—Each filter-bed must be controllable as respects quantity of effluent, excess pressure, and character of effluent. It must also be arranged so that it can be completely emptied and also be filled from below with filtered water after each cleaning.

10.—The speed of filtration in each filter-bed must be capable of adaptation to the most favourable conditions for filtration at any time, and be as regular and free from sudden fluctuations or interruptions as possible. To this end, the usual fluctuations, caused by the varying demand for water during different portions of the day, are to be equalized as far as possible by reservoirs.

11.—The filter-beds are to be so arranged that their operation will not be influenced by varying levels of the water surface in the clear-water reservoir.

12.—The excess filtration head must never be so great that breakage of the top filtering layer can occur. The limit to which the excess pressure may rise without influencing the effluent is to be determined for each plant by bacteriological investigations.

13.—The filters shall be constructed in such a manner that every portion of the surface of each bed shall work as uniformly as possible.

14.—The walls and bottom of a filter are to be water-tight, and particularly must there be no danger of an immediate connection or passage through which raw water may pass from the filter into the filtered-water main. For this purpose, special attention is to be paid to water-tight construction and maintenance of the air shafts of the filtered-water mains.

15.—The thickness of the bed of sand shall be at least so great that the cleaning will never reduce it to less than 30 centimetres (12 inches). Nevertheless it is recommended that this minimum limit should be raised to 40 centimetres (16 inches) where the conditions permit.

16.—It is desired that annual reports be made from all the sand filtration works in the German Empire to the Imperial Board of Health, giving the results of the operation, and particularly the bacteriological character of the water before and after filtration.

[Appendix.]

The nutrient gelatine is to be prepared according to the following formula, which is given simply for this particular purpose: Two parts Liebig's extract of beef, two parts of dry Witte pepton, and one part of cooking salt are to be dissolved in 200 parts of water. The solution is to be heated by steam for about half-an-hour, and filtered after it has cleared. To 900 parts of this fluid are to be added 100 parts of the best white cooking gelatine. This is to be dissolved by heating in steam for half-an-hour at the outside, depending on the source and softness of the gelatine. Thirty parts of standard soda-lye are to be added to the boiling hot liquid, and then more added drop by drop until the liquid has a neutral action on litmus-paper. After a quarter of an hour's heating in steam, the gelatine solution must be again tested for such a reaction, and, if necessary, a few more drops of the soda-lye added. One-and-a-half parts of crystallized glassy soda are then to be added to the neutral gelatine, and the latter cleared by being heated in steam for half or three-quarters of an hour, and afterwards filtered through a fine-pore filter-paper which has been damped with hot water. Immediately after filtration, the still warm gelatine is to be poured into sterilized test-tubes in quantities of 10 cubic centimetres, and sterilized in them by heating from 15 to 20 minutes in steam. This nutrient gelatine is clear and of a yellow colour. It does not become soft below 26° C., nor fluid below 30° C. Blue-violet litmus-paper is made somewhat bluer by the fluid gelatine; and the reaction on phenolphtalein is slightly acid. The jugs in which the samples are taken must be sterilized. In collecting the samples, all contamination of the water is to be avoided; and pains must be taken that during the opening, filling, and closing of the sample jug the fingers do not rest on the mouth.

As soon as possible after the samples have been taken, the cultures are to be started, in order that the sources of error may be shut out which would arise on account of the increase of the bacteria during the time the samples are stored. The gelatine plates are therefore to be prepared if possible immediately after taking the samples. In measuring the quantities of water for planting the culture-plates, pipettes are to be used with division marks allowing quantities from 0·1 to 1 cubic centimetre to

be measured exactly. They are to be sterilized at a temperature of 130° to 150° C. in a dry chamber in well-closed sheet-metal boxes.

To investigate the filtered water, it is sufficient to add one cubic centimetre of the sample to one gelatine plate. For the investigation of raw water, on the contrary, several plates are to be prepared with different quantities of water, generally with a preliminary dilution of the sample with sterilized water. The gelatines plates are to be prepared by taking the sample of water in the pipette and emptying it with the usual care into a Petri glass, and at the same time pouring in the contents of a test-tube of gelatine, made liquid by heating it to between 30° to 40° C. The water and gelatine are mixed with each other by gently and repeatedly tilting the glass. The mixture is then spread out over the bottom uniformly, and left to harden. The culture-plates are to be kept at a temperature of 20° to 22° C., protected from light and dust. For this purpose the use of an incubator is recommended. The number of colonies which have developed by the end of 48 hours after the planting of the plate is to be determined with the aid of a microscope, and, if necessary, a counting-plate. The number found in this way is to be recorded in the tables with the temperature of the cultivation.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The meeting of the Waverley Association at Melrose this week was noteworthy in two particulars. The first was the exceedingly thoughtful and otherwise excellent address by the President, Mr. W. B. M'Lusky, of Selkirk; and the second was a statement by the President to the effect that in the Waverley Association the members are held together by the qualities of the heart, and that the bond is so strong that the Association has existed and flourished for nearly forty years without ever having a single rule or bye-law. This is a remarkable history; and it is, among Gas Managers' Associations, quite unique. It will be observed that the Association, after having for two years in succession held their spring meeting in Edinburgh, have reverted to the old system of meeting only within the district embraced by the Association. This district most strangely stops short at Edinburgh, although it includes Portobello, now a suburb of the city; and the failure to include Edinburgh is all the more surprising in that it is the most Waverleyish spot on the face of the globe—nearly all the Waverley novels having been produced within it. The resolutions to meet at Selkirk and Dalkeith next year were arrived at unanimously; and I suppose the proposal was dictated by a desire to meet the wishes of some members who adhere firmly to the old custom. It is a curious circumstance that those who, three years ago, were opposed to meeting in Edinburgh, now, after experience, approve of the step; while those who were responsible for its being taken are now those who are disposed to return to the old ways.

I have been informed that the post of Manager of the Berwick and Tweedmouth Gas Company is again vacant. This is the fourth time within about as many years. So frequent changes are not made without a cause. In this case I understand the reason to be that the Manager is obliged to work under the Secretary of the Company, who has not had practical training as a gas manager. The arrangement is not a good one; and so long as it lasts, it is really not a manager the Company want, but a working foreman. Applicants for the situation will be none the worse to know this.

Mr. J. M'Gilchrist, of Dumbarton, has reported to the North Berwick Gas Commissioners regarding the site for a new gas-works. Two sites were submitted to him—one at Dirleton Railway Station, some distance from the town, and the other near the railway station at North Berwick. Mr. M'Gilchrist unhesitatingly recommends the latter. A railway siding can be made into it, and no application to the Board of Trade will be necessary. The Commissioners adopted the site; and the Clerk was instructed to ascertain the terms upon which it may be procured and an access to it obtained.

There are loud complaints in Stranraer as to the inadequacy of the gas supply. It was discussed at a meeting of the Town Council on Monday night. One member said that in his street they were living in almost darkness, and another said that the gas had been bad for years. Of course, the speakers failed to grasp the real situation. It is not that the gas is bad, but that there is not enough of it. The Gas Company are, however, in the process of remedying the defect, for they are erecting a new gasholder, which is very much needed; the storage accommodation for a maximum daily output of 56,000 cubic feet being only 36,000 cubic feet.

The Forfar Gas Corporation recently considered the estimates for the income and expenditure of the undertaking during the current year. These, with the price of gas retained at 3s. 9d. per 1000 cubic feet, show an apparent surplus of £167. The estimates were adopted, but only by a small majority, and after a discussion; there being one body in the Corporation who considered that the price should be 4s., and another who thought it should be 4s. 3d. The Corporation were, one of the speakers said, trying to sell gas at a price at which they could not make it. The speaker (ex-Provost Doig), when the resolution to retain the price of gas at 3s. 9d. was arrived at, asked that his dissent should be minuted.

The Falkirk Gas Commissioners on Tuesday had before them a report by the Works Committee which stated that Mr. M'Gilchrist had explained to them the various sites he had looked at as suitable for new gas-works, and the objections applicable to each, and that Mr. M'Gilchrist has been instructed to prosecute his inquiries; that the Manager produced a report by him for the year ending May 15 last; that the Committee were unanimous that an increase should be made in the price of gas for the remaining three quarters of the year; but that, as there was a division of opinion as to whether the increase should be 2d. or 3d. per 1000 cubic feet, the Committee left it to the Commissioners to fix the price. Mr. Cook Rennie, the Convener of the Committee, moved the approval of the report, and that the increase be 3d. He said the report by Mr. Kincaid, the Manager, showed that there was a loss on the year's working of over £800. This deficit he attributed to the former Committee having been too liberal, when they had a surplus on hand of nearly £1700, in abolishing meter-rents and reducing the price of gas by 2d. per 1000 cubic feet. If this money, he considered, had been spent upon the works, there would possibly have been no surplus at all. They were now spending more money. Wages had risen from £993 last year to £1200; and coal, from £7333 to £7870. Bailie Hamilton, the former Convener, took

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 695.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
590,000	10	Apl. 13	10½	Alliance & Dublin 10 p. c.	21½—22½	..	4 13 4
100,000	10	,,	7½	Do. 7 p. c.	15½—16½	..	4 10 11
800,000	100	July 3	5	Australian 5 p. c. Deb.	102—104	..	4 16 2
200,000	5	May 12	6	Bombay, Ltd.	6—6½	..	4 12 3
40,000	5	,,	6	Do. New, £4 paid	4¼—4½	..	5 1 1
880,000	Stk.	Aug. 16	12	Brentford Consolidated	277—282	..	4 5 1
270,000	,,	,,	9	Do. New	210—215	..	4 3 9
50,000	,,	,,	5	Do. 5 p. c. Pref.	140—145	..	3 9 0
159,375	,,	June 15	4	Do. 4 p. c. Deb.	126—130	..	3 1 7
220,000	Stk.	Sept. 15	11½	Brighton & Hove Orig.	255—265*	+¾	4 6 9
226,320	,,	,,	8½	Do. A. Ord. Stk.	190—195*	+1½	4 7 2
973,500	Stk.	Aug. 16	5	Bristol, 5 p. c. max.	125—130	..	3 16 11
430,000	20	Mar. 29	10	British	44—46	..	4 6 11
50,000	10	Aug. 31	12	Bromley, Ord. 10 p. c.	24—26	..	4 12 3
75,000	10	,,	9	Do. 7 p. c.	19—21	..	4 5 8
500,000	10	Apl. 27	6	Buenos Ayres (New) Ltd.	9½—10½	..	5 17 1
220,000	Stk.	June 29	4	Do. 4 p. c. Deb.	100—102	..	3 18 5
150,000	20	July 13	8½	Cagliari, Ltd.	28—29	..	5 13 10
100,000	10	June 1	7½	Cape Town & Dis., Ltd.	13—14	..	5 7 2
50,000	50	May 2	6	Do. 6 p.c. 1st Mort.	57—59	+1	5 1 8
550,000	Stk.	Apl. 13	13½	Commercial Old Stock	316—321	..	4 4 1
200,750	,,	,,	10½	Do. New do.	245—250	..	4 4 0
200,750	,,	June 15	4½	Do. 4½ p. c. Deb.	143—148	..	3 0 10
800,000	Stk.	June 15	10	Continental Union, Ltd.	183—187	..	5 7 0
200,000	,,	,,	7	Do. 7 p. c. Pref.	182—187	..	3 14 10
51,600	Stk.	Aug. 31	14	Croydon A 10 p. c.	335—340	..	4 2 4
168,400	,,	,,	11	Do. B 7 p. c.	265—270	..	4 1 5
555,000	Stk.	Aug. 16	5½	Crystal Palace Ord. 5 p. c.	132—137	..	3 16 8
60,000	,,	,,	5	Do. 5 p. c. Pref.	140—145	..	3 9 0
486,090	10	July 28	11	European, Ltd.	22—23	..	4 15 8
354,060	10	,,	11	Do. £7 10s. paid	16—17	..	4 17 1
14,993,075	Stk.	Aug. 16	4 1/10	Gas- 4 p. c. Ord.	105—107	..	4 11 7
3,800,000	,,	,,	3½	light 3½ p. c. max.	96—99	+1	3 10 8
3,799,785	,,	,,	4	and 4 p. c. Con. Pref.	123—125	..	3 4 0
3,993,975	,,	June 15	3	Coke 3 p. c. Con. Deb.	100—102	..	2 18 10
70,000	10	May 31	8	Hongkong & China, Ltd.	13¾—14½	..	5 10 4
3,800,000	Stk.	May 12	10	Imperial Continental	223—228	..	4 7 8
473,600	Stk.	Aug. 16	3½	Do. 3½ p. c. Deb. Red.	101—104	..	3 7 4
75,000	5	June 15	6	Malta & Medn., Ltd.	5—5½	..	5 9 1
560,000	100	Apl. 4	5	Met. of 5 p. c. Deb.	112—114	..	4 7 9
250,000	100	,,	4½	Melbourne 4½ p. c. Deb.	110—112	..	4 0 4
541,920	20	May 31	5	Monte Video, Ltd.	12¾—13½	..	7 8 1
617,946	Stk.	Aug. 31	9½	Newc'tle & Gatesh'd Con.	225—230	..	4 0 5
264,855	Stk.	June 29	3½	Do. 3½ p. c. Deb.	106—109	..	3 4 3
				* Ex div.			

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
150,000	5	May 31	8	Oriental, Ltd.	7¾—8	..	5 0 0
135,000	5	,,	8	Do. New, £4 10s. pd.	6½—7	..	5 14 3
15,000	5	,,	8	Do. do. 1879, £1 pd.	1½—1¾	..	4 11 5
60,000	5	Mar. 29	7	Ottoman, Ltd.	5½—6	..	5 16 8
500,000	100	June 1	6	People's Gas of Chicago 2nd Mtg. Bonds	102—106	..	5 13 2
851,070	10	Apl. 27	7	River Plate Ord.	11¼—11¾	..	5 19 2
250,000	Stk.	June 29	4	Do. 4 p. c. Deb.	100—102	..	3 18 5
250,000	10	Sept. 15	10	San Paulo, Ltd.	15½—16¼*	..	6 1 3
135,000	Stk.	Mar. 29	10	Sheffield A.	244—249	..	4 0 4
209,058	,,	,,	10	Do. B.	244—249	..	4 0 4
447,427	,,	,,	10	Do. C.	244—249	..	4 0 4
5,600,000	Stk.	Aug. 16	5½	South Metrop., 4 p. c. Ord.	140—143	..	3 14 7
1,520,000	,,	July 13	3	Do. 3 p. c. Deb.	101—103	..	2 18 3
120,000	Stk.	Aug. 31	6	Tottenham A. 5 p.c. and B. 3½ p.c.	141—143	..	4 3 11
250,520	,,	,,	4½		102—104	..	4 6 6
55,100	,,	—	4	Edmonton 4 p.c. Deb.	115—120	..	3 6 8
183,380	10	June 15	5	Tuscan, Ltd.	9—10	..	5 0 0
149,900	10	July 3	5	Do. 5 p. c. Deb. Red.	98—100	..	5 0 0
				WATER COMPANIES.			
746,184	Stk.	June 29	11	Chelsea, Ord.	313—318	..	3 9 2
150,000	,,	,,	5	Do. 5 p. c. Pref.	167—170	..	2 18 10
160,000	,,	,,	4½	Do. 4½ p. c. Pref. '75	148—153	..	2 18 10
175,785	,,	Mar. 29	4½	Do. 4½ p. c. Deb.	155—160	..	2 16 3
1,720,560	Stk.	Apl. 13	7	East London, Ord.	208—213	..	3 5 9
654,740	,,	June 29	4½	Do. 4½ p. c. Deb.	155—158	..	2 17 0
890,000	,,	,,	3	Do. 3 p. c. Deb.	101—103	..	2 18 3
700,000	50	June 15	7½	Grand Junction 10 p. c. max.	111—114	..	3 5 9
310,000	Stk.	Mar. 29	4	4 p. c. Deb.	135—140	..	2 17 2
708,000	Stk.	Aug. 16	14	Kent	358—363	..	3 17 2
160,000	,,	,,	7	Do. New, 7 p. c. max.	208—213	..	3 5 9
1,043,800	100	June 29	10½	Lambeth, 10 p. c. max.	298—303	..	3 9 4
406,200	100	,,	8	Do. 7½ p. c. max.	225—230	..	3 9 7
850,000	Stk.	Mar. 29	4	Do. 4 p. c. Deb.	135—140	..	2 17 2
500,000	100	Aug. 16	13½	New River, New Shares	430—440	..	3 1 4
1,000,000	Stk.	July 28	4	Do. 4 p. c. Deb.	135—140	..	2 17 2
902,300	Stk.	June 15	7½	South-wark Ord.	205—210	..	3 11 5
126,500	100	,,	7½	7½ p. c. max.	198—198	..	3 15 9
489,200	Stk.	,,	5	and 5 p. c. Pref.	167—172	..	2 18 2
1,019,585	,,	Apl. 13	4	Vauxhall 4 p. c. A Deb.	135—140	..	2 17 2
1,155,066	Stk.	June 15	10	West Middlesex	300—305	..	3 5 7
200,000	,,	,,	4½	Do. 4½ p. c. Deb.	154—158	..	2 17 0
200,000	,,	Sept. 15	3	Do. 3 p. c. Deb.	101—103*	+½	2 18 3
				* Ex. div.			

exception to the remark that the then Committee were to blame in reducing the price of the gas. He pointed out that in his day there was always a surplus; and it was two years since he was in office. The old management had not caused all the trouble. In reply to an inquiry, Mr. Kincaid said he estimated that, with an increase of 3d., there would be a loss of £82; and that, with an increase of 2d., the deficit would be fully £400. A member took the view that if they put on 3d. for three quarters they might find it to be too much for the four quarters of next year; and he thought that if they raised the price of gas now by 2d., they might, by retaining it at this figure during the four quarters of next year, be able to end square. This view prevailed; and the price of gas was raised from 3s. 7d. to 3s. 9d. per 1000 cubic feet. The rise, though it is to be regretted, was inevitable; and nothing need be said upon that head. It is about time, however, that the new Committee should cease throwing stones at the old. Bailie Hamilton, as representing the old, is not in any way obstructing Mr. Cook Rennie in his work; and his policy should be let alone. It should not be lost sight of that Bailie Hamilton's policy was homologated by the whole Council of the day. The belief is now that it was founded upon error, and it has been changed, to the effect of charging to revenue much that used to be put to capital. This is certainly the proper way to conduct a gas undertaking. But, so far as I can see, Bailie Hamilton takes no objection to the new policy. It is therefore a mistake on the part of the new Committee to be continually hitting out at the old. If on no other ground, it is so in this sense—that admittedly there is sufficient to do at Falkirk to require the energies of the whole Council; and the object of all should therefore be rather to endeavour to heal divisions than to create them. In the course of the discussion, the past management came in for a good deal of adverse comment. Everything was, it was said, found to be out of order. Grant that this was so, I should like to point out that the make of gas has increased since 1895, when the Corporation took over the undertaking, from 67 to 100 million cubic feet a year, without much increase in the manufacturing plant; and, further, that it has been found necessary, since the old management retired, to make such a large increase upon wages. The inference is that probably the Commissioners did not provide the means wherewith to keep the works in good order.

The consumption of gas at Denny has increased by 10 per cent. during the past year. Owing to the increased price of coal, it has been resolved to raise the price of gas from 3s. 7d. to 4s. 2d. per 1000 cubic feet.

The Police Commissioners of Cowdenbeath this week considered a report by Mr. H. Pooley, of Dunfermline, regarding the question of their promoting a transfer of the undertaking of the local Gas Company to them, and converting the works into a coal-gas works. The Commissioners, in view of Mr. Pooley's report, concluded that they would not be able to come to terms with the Gas Company; and they then proceeded to make arrangements for the lighting of the streets by means of paraffin lamps. The step, it was acknowledged, was a backward one; but the Commissioners felt themselves obliged to take it. Verily, the attempt to introduce acetylene gas, for all purposes, has not been a success in Cowdenbeath.

The Perth Gas Commissioners this week let the contracts for the erection of the buildings in the new gas-works. The work will be proceeded with at once. Contracts for the manufacture of the plant have already been placed.

The Town Council of Dunfermline last Monday heard an appeal by themselves, in their capacity as Gas Commissioners, against the valuation put upon the gas undertaking by the Assessor for the burgh, who had fixed the figure at £4299. The Commissioners desired a deduction to be made from this sum of £2508, which was the amount of their contribution to the sinking fund for the liquidation of the debt upon the undertaking. There was another question at issue, with reference to the allocation of the amount among the Local Authorities interested; but this was a minor point. As to the sinking fund, the Assessor was easily able to show authority for taking it into account in fixing the valuation; and the appeal was accordingly dismissed. The allocation is also to stand, subject to adjustment. Several members of the Court grumbled at the method of valuation being upon the amount of profit, which they characterized as being an income-tax valuation. It was a natural grumble; for it is admitted that the present method is not an ideal one, in this respect—that it enables the owning body, by keeping down profits, to reduce the valuation at will. But then no better method has been discovered, for, after all is said, the valuation of a gas or water works is just what can be earned by them—that is, what they would produce to a person who might require to live by them.

In a Valuation Court at Ardrossan, the West Kilbride Gas Company appealed against the valuation of their undertaking being fixed at £239, and asked that it be reduced to £110. The Company, it was said, had only been in existence for two or three years; and they asked that the valuation should be made upon the profits for a year or two, instead of upon those of last year, which was the best year of the Company's existence. The Assessor replied that he had proceeded in accordance with the decision of the Court of Session in other cases. The Court reduced the valuation to £200.

The Commissioners of Dunoon on Tuesday agreed to adopt the Burghs Gas Supply Act, with a view to their carrying through an agreement with the Gas Company for the transfer of their undertaking.

The Finance Committee of the Edinburgh and District Water Trust reported to a meeting of the Trust this week that the actual expenditure for the past year was £107,948, as against the estimate of £105,419; while the revenue was £110,076, as against the estimate of £103,864. For the current year, the expenditure is estimated at £107,444, and the revenue at £107,392. The domestic rate for the year is again fixed at 5d. per pound, the shop rate at 2d., and the public rate at 1d. The principal items in the estimate of the expenditure are £3935 for salaries, as compared with £3783 expended last year; £6408 for wages, as against £6257; £4900 for repairs, as against an actual expenditure of £3908 last year; £31,816 for interest, compared with £26,590; £24,012 for annuities, the same figure as last year; £13,668 for sinking fund, as against £13,308; and £7554 for distribution pipe renewal, as against £13,359 spent last year. The rates are expected to realize £102,001. The report was adopted.

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CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Sept.* 16.

Sulphate of Ammonia.—At Leith, there has been a slight improvement; but elsewhere prices have barely been maintained. The closing quotations are £11 18s. 9d. to £12 2s. 6d. per ton, delivered f.o.b. at the ports. Makers continue to offer their production as it becomes available. On the other hand, there has been more buying going on; but buyers have supplied themselves as sparingly as possible, and demand has not been sufficient to stop the downward tendency. In the forward position, London quotation remains at £11 15s. per ton, Beckton terms, October-March delivery; but speculators are offering abroad freely at a discount on the equivalent of the price.

Nitrate of Soda is steady, on spot, at 7s. 9d. per cwt. for fine quality.

LONDON, *Sept.* 16.

Tar Products.—Generally speaking, business is moving steadily. For carbolic acid a little higher price is being offered; the production, it is stated, being disappointing. For pitch, the price shows considerable variation—more than is usually the case—at the different ports of shipment, arising probably from the want of uniformity in freights. From this cause there is a variation of certainly 3s. to 5s. per ton; the prices below being the averages, taking all U.K. ports into account. A fair outlet continues for naphthas; and for crude, which has been so long neglected, a better inquiry has commenced. A moderately firm market prevails both for creosote and for creosote salts. There is no change in the position of anthracene; and benzol, which looked like seeing better prices a few weeks ago, continues uneventful.

The week's average values are: Tar, 16s. 6d. to 25s. 6d. Pitch, east coast 34s. 6d., west coast 33s. Benzol, 90's 8d., 50's 9¼d. Toluol, 1s. 2d. Solvent naphtha, 1s. 2d. Heavy naphtha, 1s. 1½d. Crude, 30 per cent., naphtha, 4d. Creosote, 3⅜d. Heavy oils, 65s. Carbolic acid, 60's 2s. 1d., 75's 2s. 7½d. Creosote salts, 50s. Anthracene, nominal, "A" 3½d., "B" 2½d.

Sulphate of Ammonia.—The course of this market is disappointing, especially having regard to the undoubted fact that producers have no stocks. Dealers continue to quote lower prices than makers will accept, and in one or two cases, it is said, have booked large business which has yet to be covered. Offers are freely made of from £11 15s. to £11 18s. 9d. per ton, less 3½ per cent.; but, so far, few makers will accept less than £12. The production is undoubtedly increasing; but, on the other hand, both demand and shipments are large, and enlarging.

The Charge for Gas for Public Lighting at Bury St. Edmunds.—The representatives of the Bury St. Edmunds Town Council on the Board of the Gas Company reported to the former last Tuesday that, after a long discussion, the Directors had agreed that the charge for gas for public lighting should be 2s. 4½d. per 1000 cubic feet. This is a compromise between the present price of 2s. 3d. and 2s. 6d. demanded.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—In the coal trade here an enlarged weight of business has been coming forward during the past week. House coals especially have been in considerably increased demand, consumers no doubt being anxious to get in supplies before the forthcoming advance; and little or nothing is now being put into stock. The extent to which prices will be put up when the advance is officially announced will no doubt be settled at a meeting of the Sales Association to-day. Prices during the week have been firm at 11s. 6d. to 12s. 6d. per ton for best Wigan Arley, 10s. to 11s. for Pemberton four-feet and seconds Arley, and 9s. 6d. for common house coal. Now that the holiday stoppages in the various Lancashire manufacturing centres are at an end, business in steam and forge coal and engine fuel is getting back to its normal condition. Common round coals are in active request for steam and forge purposes, and firm at about 8s. 9d. to 9s. 3d. per ton at the pit. For engine fuel, supplies at most collieries are short to meet the full requirements of customers. Prices are strong at about 6s. 9d. to 7s. 3d. per ton at the pit for best sorts, 6s. to 6s. 6d. for medium, and 5s. 6d. for common slack. Shipping business is fairly good, with steam coals ranging from 9s. 6d. to 10s. per ton delivered at the Mersey ports or the Ship Canal. Coke continues in very brisk demand, with foundry qualities fetching 26s. to 27s., and furnace sorts about 20s. per ton at the ovens.

Northern Coal Trade.—There is weakness in the steam coal trade, through the reduction of the shipments to the Baltic; but other branches are active, and the prices of some qualities are advancing. Best Northumbrian steam coals are dull; and the price varies from 11s. to 11s. 6d. per ton f.o.b. Steam smalls are about 6s. 6d. per ton. Manufacturing coals are steady, and rather scarce; and prices are firm generally. In the gas coal trade, there is increasing activity, and some scarcity, which is unusual at this early part of the season. Deliveries, however, are pressed for by many companies; and there is now a desire to contract for next year's supplies, so that the prices are kept firm, and have an upward tendency. Current quotations are from 10s. 6d. to 11s. per ton f.o.b.; and while these figures are only given for occasional cargoes, it is reported that 10s. per ton has been paid for delivery f.o.b. over next year. Higher prices are asked for forward cargoes. Gas coke is steady, and the general price is now 14s. per ton f.o.b.

Scotch Coal Trade.—The market is slightly easier; demand having slackened off to a small extent. Supplies are plentiful; and unless a large demand for export should arise, it will be impossible to maintain present prices. Already, for immediate delivery, rates are somewhat down. For forward delivery, there is no change. The prices quoted are: Main 9s. to 9s. 3d. per ton f.o.b. Glasgow, ell 9s. 6d. to 10s. 3d., and splint 9s. 9d. to 10s. The shipments for the week amounted to 213,367 tons—an increase upon the previous week of 27,969 tons, but a decrease upon the corresponding week of last year of 14,892 tons. For the year to date, the total shipments have been 6,069,655 tons—a decrease upon the corresponding period of last year of 767,617 tons.

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The Public Lighting of Bristol.—The annual report of the City Engineer of Bristol, in a reference to the public lighting, states that the length of highways lighted by electric arc lamps is 10½ miles, the number of arc lamps 305, the number of incandescent lamps 10, and the number of gas-lamps 7463.

The Water Supply of Smethwick.—The Smethwick District Council had a report presented to them last Tuesday by the Health Committee with reference to the recent drought and the scarcity of water, and recommending that the attention of the Local Government Board be called to the deficient and inadequate water supply provided by the South Staffordshire Water Company, and that the question should be asked whether the Department would be prepared to assist the Council, both in Parliament and otherwise, with a view to the promotion of, and obtaining, an Act to enable them to provide a supply of water from a source other than the South Staffordshire Water Company. The Public Works Committee reported that the deputation appointed by the Council had met the Directors of the Company, who promised that their Engineer should, in company with the Council's Surveyor, examine and test the mains throughout the district; and, if found necessary, new and enlarged ones should be put down. They also stated that three new pumping-engines were being provided, which would improve the pressure to Smethwick.

Falmouth Gas Company.—At the annual meeting of this Company on Monday last week, the Chairman (Mr. J. Mead) said the expenditure on the new plant was working out thoroughly satisfactorily. They had saved £100 by the adoption of water gas, and there was a large profit to be made on its manufacture. The price of gas would be raised to 3s. 8d. per 1000 cubic feet. Coals had gone up 1s. 6d. a ton, and there had been put upon them expenses over which they had no control. But for law costs, arising out of the re-valuation, their profit would have been £1700, instead of £1300. Next year they would aim at £2000 profit, because the concern would not be in a paying position without it. They had expended £5000 on works which would enable them to go on as at present for fifteen or twenty years. If they had not made this outlay, and had to move the works, they would have had to face an expenditure of about £50,000. He moved the payment of a dividend of 6¼ per cent. for the half year; and it was agreed to. The Chairman then referred to the gas and water works purchase scheme, and said the Directors had never been able to see that it was possible for an outside body to take over the gas-works and make a profit for the town. As business men, they knew the difficulties they had to cope with; and it took them all their time to make their dividends. How would it be possible for novices to take over such a business, for they were being continually moved from office? When anybody could show him in black and white that a reduction of rates to the town would accrue from the purchase of the gas-works, he was quite prepared to lay the matter before the Board, and the shareholders would feel the same as he did. They had no objection to the town getting the profit, because they knew it would have to pay them a good round sum, and they would be recompensed. The town had had a narrow squeak of taking over a white elephant, which it would be a very serious thing for them to feed for a long time to come.

Horbury and the Ossett Gas-Works.—The Horbury District Council have declined to join the Ossett Corporation in the purchase of the Ossett Gas-Works; but they do not appear to have yet come to a decision on the alternative suggestion that they should support a Bill to be promoted by the Corporation empowering them to acquire the works.

Faversham Corporation and the Water-Works.—The ratepayers of Faversham, in public meeting assembled, lately passed a resolution recommending the Town Council to acquire the Water Company's undertaking; and the former have resolved to take steps to carry out the wishes of their constituents. The Directors of the Company have a scheme in hand for providing a new reservoir and deepening the present wells; the estimated cost being £6000.

Theft of Electricity Not a Criminal Offence in Germany.—Some time ago, three mechanics secretly attached wires to the circuit in the house in which they lodged, and in this way lighted their rooms without expense. They were sentenced; but there was an appeal to the Supreme Court. It was there held that those properties are wanting in electricity which would be necessary to constitute it a movable object in the sense of the law; and electricity must be reckoned as one of the energies of Nature, like light, sound, and heat. The laws relating to larceny provide only against the theft of "movable" bodies, and therefore would be considered inapplicable in this case.

Dover Gas Company.—At the recent half-yearly general meeting of this Company, the Chairman (Mr. W. Mannering), in moving the adoption of the report, noticed in the "JOURNAL" for the 29th ult., said it was gratifying to record that in the six months ending June 30 there had been the large increase of 8·93 per cent. in the sales of gas over the corresponding half of 1898. This was mainly due to the prepayment-meter system, which had been received with great favour by a large number of householders. At the end of last year, there were 270 slot-meters in use; and during the past six months 484 were fixed—making a total of 754. Since then the number had been augmented to upwards of 1100. With reference to the financial position of the Company, he said that, although the price of coal had been higher and the selling price of gas lower, the full dividend had been earned within £282; and after paying it, there would be a balance of £3237 to be carried forward. As to manufacture, during the half year 9644 tons of coal were carbonized. After referring to the quantity of gas made and sold, the Chairman stated that the buildings had been well maintained, and the whole of the plant was in a thorough state of efficiency—in fact, that the affairs of the Company were in all respects most satisfactory. In conclusion, he said he felt they owed a debt of gratitude and thanks to the officers and staff, including the workmen, for their continued faithful and valued services, and particularly to the outdoor and clerical staff, for the willing and cheerful manner in which they had discharged their greatly-increased duties through the introduction of the prepayment-meter system. The report was adopted, and a dividend for the half year at the rate of 7½ per cent. per annum (less income-tax) was declared. The proceedings closed with votes of thanks to the Directors and to the staff, acknowledged by the Chairman and the Engineer (Mr. R. Herring).

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Lincolnshire Water Scheme Vetoed by the Local Government Board.—The Local Government Board have declined to sanction a scheme of the Crowland (Lincs.) District Council for supplying that town with water by means of an artesian bore. The scheme is condemned as incomplete and defective; and the Board urge immediate attention to a new scheme based on the best geological advice, and more complete in its method of distribution. The Engineer has now been instructed to draw up a fresh scheme for submission to the Board.

Rotherham in Darkness.—The "Sheffield Independent" reports that last Thursday evening, about 20 minutes to nine, the borough of Rotherham was plunged into darkness through a temporary failure of the supply of gas from the Corporation works, caused, it is supposed, through a mistake on the part of a workman. For a time there was some little confusion in the town. The lamps illuminating the streets, and the gas in nearly every institution and private dwelling, went out. At the railway stations and elsewhere darkness prevailed. Fortunately, no accident resulted from the occurrence.

Water Scheme for the Newton-in-Makerfield District.—At a meeting recently held of the Newton-in-Makerfield District Council, several important recommendations were made for improving the water supply. The Chairman of the Special Water Committee submitted a report as to proposed works for a town's supply, and gave estimates of the cost for carrying out the scheme in three stages. The Council resolved that the complete scheme prepared by the Water Engineer, in consultation with Mr. D. M. F. Gaskin, M.Inst.C.E., be approved, and completed in three stages as suggested, the first to cost a sum not exceeding £7000, to be proceeded with immediately, under the powers of the Newton Improvement Act of 1855; also that the Council make application to the Local Government Board for sanction to borrow about £6000 and £9000 respectively for the completion of the second and third stages of the scheme. As soon as the sanction of the Board has been obtained, the second portion will be proceeded with.

Death from Gas Poisoning in Liverpool.—A man named Lawrence Eelbeck, 43 years old, a compositor, said to be out of employment, was found dead at his residence in White Rock Street, Liverpool, last Tuesday morning. He went to bed about 11.15 on Monday night; sleeping alone in a small back room. On his wife going to arouse him the following morning, she noticed a strong smell of gas; and on entering the room she found her husband dead on the bed. It appears there is a gas-pipe in the room without a bracket; and a plug of wood was put in the pipe with soap over it, to keep the gas from escaping. It was found that someone had hung a shawl on the pipe, loosening the peg; and it is supposed that, when the gas was turned on in the house, it forced the loosened peg from its place—causing a great escape of gas, and the suffocation of the unfortunate man. At the inquest on Wednesday, it transpired that the deceased went to bed on Monday night in a state of intoxication. Medical evidence was also given to the effect that deceased had congested lungs; so that very little inhalation of gas would, under the circumstances, prove fatal. A verdict of "Death from gas poisoning and suffocation" was returned.

Heavy Payment for Coal under a Reservoir.—The Wakefield City Council have adopted a recommendation of the Water Committee that Messrs. Holliday and Sons be paid £7000 in respect of their rights (exclusive of royalties) in 35a. 3r. 24p. of the Middleton Little coal lying under the Corporation reservoir at Ardsley. It was felt that it would be cheaper to pay £7000 than to go to arbitration, and have a whole host of skilled witnesses to pay.

A New Water Scheme for Shrewsbury.—At the meeting of the Shrewsbury Town Council yesterday week, Mr. P. H. Jones moved that a report on the water supply which had been submitted by Messrs. Taylor, Sons, and Santo Crimp be referred to the Water Committee to consider and report upon. Several schemes were alluded to in the report; the best being the Batchcot upland scheme, the cost of which was estimated to be £170,000 for the works only—the cost of land not being given. What the Council wanted was the full cost as near as could be in each case; and to get this and other information was, Mr. Jones said, the object of his motion. The proposition was eventually agreed to.

Windsor Gas Company.—The half-yearly meeting of this Company was held last Friday week. A particularly gratifying feature of the Directors' report was an announcement that the business continues to progress, and that the sale of gas in the six months was in excess of what it was during the corresponding period of the preceding year, notwithstanding that the public lamps are not now supplied with gas. The total revenue amounted to £9348, and the expenditure to £7293—giving a profit balance of £2055. The balance on profit and loss account was £5951; and from this the statutory dividend is to be paid. The Directors referred to the increase in the price of coal and other material, and stated that, in consequence, they had "thought it advisable to advance the price of coke, breeze, and tar." The report and accounts were adopted.

The Position of the Bradford Water Supply.—The Deputy-Chairman of the Bradford Corporation Water Committee presented a statement at last Tuesday's meeting of the Council which showed that there was a considerable diminution of the water in storage on the previous day compared with the corresponding day of last year—viz., 666,717,000 gallons, as against 1,011,899,000 gallons, or a decrease of 345,182,000 gallons. Notwithstanding this, Mr. Milner was in a position to inform the Council that it might be safely taken that, if they obtained no water from the upper reaches of the Nidd for some time, they would never be in the present plight again; and for this reason—they were now getting from Upper Barden 5 million gallons of water per day, 6 million gallons along the old conduit, and they had for a period been receiving a million gallons a day from the high-level service. Altogether, for a considerable time there had been a supply of nearly 12 million gallons a day. He did not think they were so badly off; anyway, he should not call this a scarcity of water. There was more water being used than ever there was; but there need be no fear after the present time. Water from the upper reaches of the Nidd would not be obtained for two years. Greenhow Hill Tunnel was not finished, and then it had to be lined, which could not be accomplished in less than two years.

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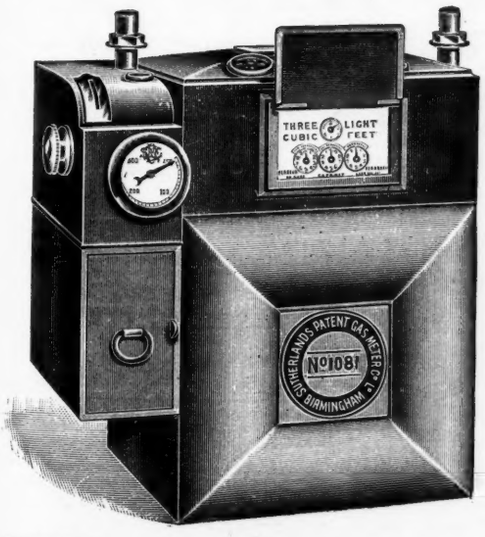

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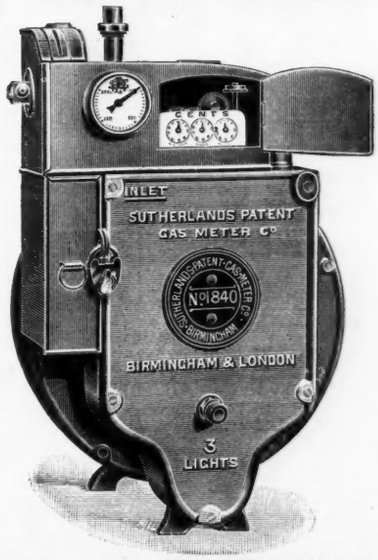

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Sheffield and the Derwent Valley Water Board.—The Sheffield Corporation have appointed the Lord Mayor (Alderman W. E. Clegg), Alderman Gainsford, and Alderman Styring to represent them on the Derwent Valley Water Board until November next year. All three gentlemen have done eminent service for the borough in securing a share in the waters of the Derwent.

The New Departure by the High Wycombe Gas Company.—The "Builder" of this week contains a very appreciative notice of the circular recently issued by the High Wycombe Gas Company, to which reference was made in the "JOURNAL" for the 29th ult., announcing their intention to let gas-engines on hire, or on the hire-purchase system, and to periodically inspect and renew burners, &c. Our contemporary says: "The policy of supplying burners and cooking stoves to consumers free of charge has recently been adopted in several provincial towns, such as Blackpool. But the circular from High Wycombe indicates a bolder spirit of enterprise than has yet been shown elsewhere; and much credit is due to Mr. J. F. Wicks, the Manager to this Company, as a pioneer of a system which will undoubtedly become general throughout the country in the immediate future, and which will certainly increase the popularity of gas among ordinary householders."

The Proposed Supply of Water Gas by the Alliance and Dublin Gas Company.—Some of the writers in Dublin newspapers are quite hysterical over the proposal of the Alliance Gas Company to supply water gas in the city; and they accordingly indulge in more or less incoherent and exaggerated language. The "Daily Nation" for the 15th inst. devoted a leading article to the subject, characterizing the project as a "danger to Dublin;" the "Evening Herald" calls upon the Public Health Authorities to interfere; and the "Daily Independent" criticizes the scheme adversely because, according to rumour, it will throw a number of men out of work. These articles bear strong evidence of having been inspired; and a writer signing himself "Anti Humbug" has pointed out, in a letter to the first-named paper, that the phraseology used in their article is, in many respects, "almost identical with that of a report made by an individual the nature of whose office implies that he should be, what he is not, an impartial person." There is much significance in these words. The writer of the letter gives a list of Corporations and Gas Companies who have been supplying mixed coal and water gas for some years past, and expresses the belief that, in the Dublin case, the plans of the works were passed by the Corporation after being for some time under the consideration of two Committees, one being the Public Health Committee. In addition to this opposition to the project on public grounds, trouble has arisen with the Port and Docks Board. The Company wish to lay a pipe through the Board's property, in order to convey the oil required for making the water gas direct from the ship to the works. The Board have demanded a wayleave of £200 a year for this privilege, and the Company have not only refused to pay it, on the ground, as they contend, that the Board have no power to enforce it, but have intimated that they can do the work without permission. As the Board persist in making their claim, there will possibly be litigation over the matter.

Deaths from Gas Poisoning in San Francisco.—The large number of deaths from asphyxiation by gas in San Francisco during recent years has had the effect of directing official attention to the quality of the city's illuminant. An expert analysis shows that the gas furnished by one Company contains an average of 16·44 per cent. of carbon monoxide; while that supplied by other makers contains 24·33 per cent.

Rothwell Gas Company.—At the half-yearly meeting of this Company yesterday week, it was reported that the total receipts amounted to £2484, and that there was £1482 available for dividend. After payment of the maximum dividend, the carry-forward would be increased to £818. The Chairman (Mr. H. P. Newsome) suggested that the present was a favourable time to abolish meter-rents. The consumption of gas by the ordinary or private consumers had more than doubled since 1895. The report and accounts were adopted.

The Fatal Gas Explosion at Dudley.—The inquiry relating to the gas explosion at the Hope Tavern, Netherton, near Dudley, on Aug. 24, whereby three men lost their lives, was proceeded with last Tuesday by Mr. F. W. Ensor, the Deputy Coroner for the district. The evidence of Richard Harrison, the landlord of the tavern, was first taken. It appeared that he detected a strong smell of gas on the 24th ult., shortly after a traction-engine drawing three trucks passed the house. He reported the matter to Mr. George Collins, the Manager of the gas-works; and a man was sent to examine the premises. Failing to find the escape in the house, the man again turned on the gas at the meter. He subsequently told witness that he had discovered the leakage in Swan Street. The explosion occurred about 11 p.m., when there were six customers in the bar. Some of the persons who were in the house at the time were also called. Afterwards Edward Haycocks, a labourer in the employ of the Gas Company, gave an account of his search for the leakage in Swan Street. He found that a 2-inch main was broken completely through; and the gas was escaping from it in a considerable volume. The gas-main was only a foot below the surface of the road; and 3 feet under the main was a 6-inch drain-pipe. There was a depression along the course of the drain, around which the soil had not been rammed down closely. William Hadden, who examined the gas-fittings in the house, stated that he found them all intact, but warned the landlord to be careful, and not to sleep in the house that night. Mr. Collins stated that he sent Hadden to investigate the complaint made by Mr. Harrison. When he heard of the explosion, he reduced the pressure at the works, and went directly to the spot to superintend the search for the escape. After the discovery of the fracture, he had the excavations continued, and found a 4-inch drain running at right angles to the gas-main. The earth round the drain was very loose. The gas had evidently found its way along the course of the drain through the loose earth into the cellar of the Hope Tavern. The mains were purposely laid near the surface in the Netherton district, which was subject to mining subsidences, so that fractures might be more easily detected. Traction-engines and steam-rollers had broken mains at a depth of 2 ft. 6 in. The Jury returned a verdict that the deaths were caused by an explosion of gas, resulting from the fracture of the gas-main.

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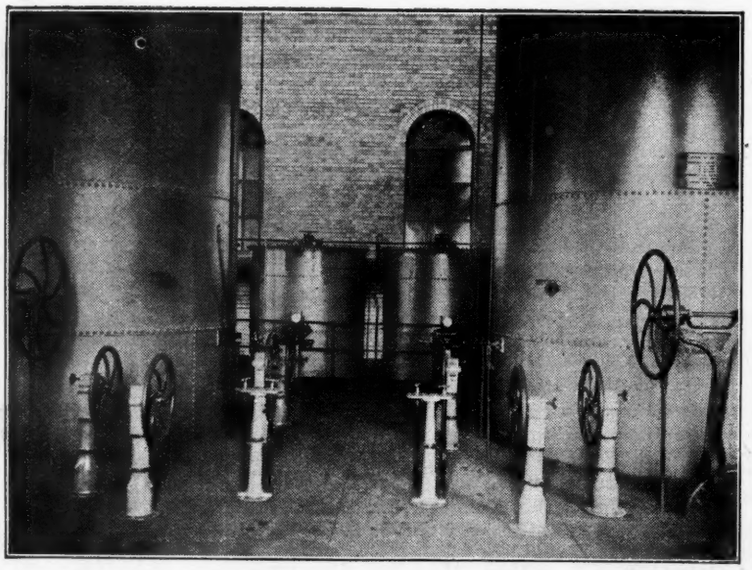

RESULTS PROVE EFFICIENCY.

Working Floor of Generator House. One Quarter Section of Birmingham Plant, Windsor Street Station.
The Maximum Daily Capacity of the Birmingham Corporation's Plant, which was erected by this Company, is 10 MILLION CUBIC FEET.

Improvement of the Brynmawr Water Supply.—Colonel A. C. Smith, R.E., held an inquiry a few days ago with reference to the application of the Brynmawr District Council for sanction to borrow £6000 for the improvement and extension of the water supply. Mr. John Thomas, Clerk to the Council, stated that the population was now estimated to be above 7000. The Council thought the original water-works, which were constructed in 1852-3 for 4 million gallons, and increased to 8¼ millions in 1865-6, were too limited in every respect. The supply was wholly dependent upon the rainfall. Last year the reservoir was empty, and the inhabitants were left without water for five weeks. It was proposed to increase threefold the storage capacity of the reservoir; and by bigger mains to enlarge in proportion the supply to the inhabitants. Mr. J. Edwards, on behalf of the Duke of Beaufort, stated that his Grace would make a free grant to the Brynmawr Council of any part of the manor in the vicinity, or any stream for the improvement of the water supply, subject to the rights of the commoners. Other evidence in support having been given, Mr. J. R. Williams opposed the scheme, and maintained that the present reservoir, if kept in proper order, was quite large enough for the district. Mr. D. A. Davies also opposed what he characterized as the extravagant expenditure of £6000. The Inspector afterwards visited the works.

Falmouth Water Supply.—The discussion respecting the purity of the water supply of Falmouth and Penryn has been revived. Reports presented to the Corporations of both towns complain that no adequate steps have yet been taken by the Falmouth Water Company to protect streams flowing into the reservoirs from the possibility of pollution from farm lands and dwelling-houses in their vicinity; and though it is admitted that the water is filtered, a good deal of dissatisfaction is expressed in reference to the present arrangements. The Falmouth Corporation have decided to call the attention of the Manager of the Company to certain features to which they object. The Penryn Corporation have communicated with the Local Government Board, and asked for a searching investigation into the whole question of the supply, which they say "is the cause of the greatest possible terror and alarm" to them. In the meantime, the Mayor of Falmouth, who was the moving spirit in the abortive schemes for the purchase of the water and gas works, has written to certain people who complained of an inadequate supply in their district, and again suggests that control of the water supply should be vested in the Corporation. He points out that if they acquire the water undertaking alone it will be necessary to charge the rates with an annual sum of £600 in order to carry out the improvements necessary. This item would be met by profits from the gas-works, if the Corporation took over the two concerns; but as the ratepayers did not approve of the joint scheme, he thinks they may be prepared to pay the cost of the purchase of the water-works alone, in order to put an end to the present doubts as to the wholesome character of the water. There is no lack of criticism of the supply.

Aldeburgh Water Supply.—It appears from a report presented to the Local Government Board by Dr. Deane Sweeting that the water supply of Aldeburgh is anything but adequate to the requirements of this rising Suffolk watering-place. The reservoir is small; and the filtering plant is described as primitive. According to Dr. Sweeting, the reservoir is said to be never emptied by the pumping that is practised. But he learned that, during the construction of the pumping-well it was on one occasion entirely emptied by 20 minutes' continuous working of a 6-inch portable centrifugal pump. Since the reservoir holds, at its maximum, only some 88,000 gallons, and since some 1700 people habitually consume the water, its maximum contents are equal to less than two days' consumption, at 30 gallons per head per day. When, as during the summer season, visitors to Aldeburgh double the population, pumping must—seeing that the service-tank holds only some 10,000 gallons—be frequently resorted to. At such times it is highly probable that the reservoir must be pumped to exhaustion, unless, of course, the pumping-well receives much soil water directly through its pervious walls. It seems that a good deal of the water is drawn from a porous shingle full of ill-constructed cesspools.

The Water Supply of Scarborough.—Included in the Water Committee's minutes presented at the meeting of the Scarborough Town Council yesterday week, was a long report from Mr. W. Millhouse, the Corporation Water Engineer, dealing with a scheme for the better distribution of water in the town, at an estimated outlay of £10,970. Mr. Millhouse states that the consumption at the maximum has now reached a point beyond which the present trunk mains cannot give the required supply. He has experienced great difficulty during the past month in keeping the high-levels at the extreme ends of the town supplied, while endeavouring to properly supply the central and business parts at a lower level. There is an ample supply of water available, and there is no necessity to suggest restriction. It is proposed that a new reservoir should be built at Spring Hill, 200 feet diameter and 17 feet deep, to hold about 3 million gallons. The supply for this reservoir will be pumped from Irton. The water will be conveyed from the existing Irton pumping-main by the present pipes as far as the top of West Bank, from which point to the reservoir a new 10-inch pumping main will be required. When the town needs more water than the existing pumping power will supply, Mr. Millhouse proposes that a new engine and boilers should be put down at Irton, together with a proper softening plant.

As will be seen by an announcement which appears elsewhere, Mr. Alfred Richards will offer for sale at the Mart, on the 10th prox., a new issue of £5000 of ordinary stock of the Plymouth and Stonehouse Gas Company, some "A" and "B" stock of the Tottenham and Edmonton Gas Company, stock of the Reigate Gas Company, some £10 shares and a £100 debenture of the Sutton Gas Company, and some fully-paid £10 shares of the Newhaven Gas Company.

NOTICE TO ADVERTISERS.—COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office *not later* than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or Stoppages of, PERMANENT ADVERTISEMENTS should be received not later than the FIRST POST on SATURDAY.

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Telegraphic Address: "PORTER, LINCOLN."
[For Illustrated Advertisement, see Sept. 5, p. 618.]

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WANTED, a Working Foreman Lamp- LIGHTER for a Gas-Works about 20 miles from London. One used to Incandescent Lighting, and with a knowledge of Fitting, preferred. Wages 24s. per week.

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FOR SALE, cheap to clear out—

One upright GAS-COMPRESSING PUMP, with two Double-Acting Cylinders, suitable for Hand or Power.

One 7 ft. by 2 ft. Railway Carriage GAS CYLINDER (German make), with Reducing-Valves, Pressure-Gauge, Regulator, Two Lamps, &c., complete.

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Several Sets of modern RETORT IRONWORK.
Four Wrought-Iron ANNULAR CONDENSERS.
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The Council do not bind themselves to accept the lowest or any Tender.

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Tenders to be lodged with the undersigned on or before the 7th day of October next.

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JAMES M'G. JACK, Clerk.

25, Waterloo Place, Edinburgh, Sept. 14, 1899.

COUNTY BOROUGH OF BURY.

(GAS DEPARTMENT.)

THE Gas Committee invite Tenders for the removal of their surplus COKE. Estimated quantity, about 3000 Tons. To be removed between the 1st of October, 1899, and the 31st of March, 1900.

Form of Tender and Conditions forwarded on application to Mr. H. Simmonds, Engineer and Manager, Gas-Works, Bury.

The Gas Committee do not bind themselves to accept the highest or any Tender, or consider any Tender for a quantity of less than 500 Tons; and further reserve to themselves the right to allot the quantity offered in such quantities as they may think fit.

Sealed Tenders, endorsed "Coke," to be delivered to the undersigned on or before Saturday, the 23rd of September, at Nine a.m.

JOHN HASLAM, Town Clerk.

Corporation Offices, Bank Street, Bury, Sept. 8, 1899.

NEWTON-IN-MAKERFIELD URBAN DISTRICT COUNCIL.

TENDERS FOR ABOUT 300 TONS OF CAST-IRON PIPES.

THE above Council invite Tenders for an estimated quantity of 300 Tons in weight of 14-inch, 8-inch, 6-inch, 4-inch, and 3-inch diameter respectively of TURNED and BORED CAST-IRON SOCKETED PIPES and a small quantity of open SOCKET SPECIAL PIPES.

Tenders to be made on Forms which, together with a Specification, may be obtained of the undersigned.

Such further Information as may be necessary may be obtained of Mr. Lloyd, Gas and Water Engineer, Town Hall, Earlestown, Lancashire.

Sealed Tenders, endorsed "Tender for Cast-Iron Pipes," and addressed to the Chairman of the Gas and Water Committee, to be delivered to me at my Office not later than Saturday, the 30th day of September inst.

The Council do not bind themselves to accept the lowest or any Tender.

W. W. SHIRLEY, Clerk to the Council.

Clerk's Office, Town Hall, Earlestown, Lancs., Sept. 14, 1899.

COMMERCIAL GAS COMPANY.

THE Directors of the Commercial Gas Company are prepared to receive TENDERS for the Surplus BREEZE produced at their several Works, for the Twelve Months ending the 30th of September, 1900.

The quantities are estimated to be as under; but the same cannot be guaranteed, and may be more or less:—

At the STEPNEY WORKS, on the Regent's Canal—
1000 chaldrons (of 48 bushels) of Fine Coke Breeze, and 1000 chaldrons (of 48 bushels) of Rough Pan Breeze.

At the WAPPING WORKS, on the River Thames—
2000 chaldrons (of 48 bushels) of Fine Coke Breeze, and 2000 chaldrons (of 48 bushels) of Rough Pan Breeze.

At the POPLAR WORKS, in Bow Creek (free waterway)—
5000 chaldrons (of 48 bushels) of Fine Coke Breeze, and 5000 chaldrons (of 48 bushels) of Rough Pan Breeze.

The Tenders may be for the whole or for one or more Works separately.

The Contractors must give security to remove the Breeze as it accumulates, to pay for the same monthly, and generally for the due fulfilment of the contract.

The Form of Agreement to be signed can be seen at the Company's Offices.

Tenders, sealed and endorsed "Tender for Breeze," to be delivered here not later than the 5th of October prox.

The Directors reserve to themselves the right to accept any Tender in part or in whole, and do not bind themselves to accept the highest or any Tender.

Commercial Gas-Works, Stepney, E., Sept. 15, 1899.

COMMERCIAL GAS COMPANY.

NOTICE is Hereby Given, that an ORDINARY MEETING of the Commercial Gas Company will be holden at the Cannon Street Hotel, in the City of London, on Thursday, the 5th of October, 1899, at Twelve o'clock at Noon, to receive the Directors' Report and the Accounts of the Company for the Half Year ended the 30th of June, 1899, to declare a Dividend, and to elect an Auditor.

The STOCK TRANSFER BOOKS WILL BE CLOSED from the 22nd of September inst. to the 5th of October next, both days inclusive.

By order of the Board, H. D. ELLIS, Secretary.

Offices: Stepney, Sept. 13, 1899.

BRITISH GASLIGHT COMPANY, LIMITED.

NOTICE is Hereby Given, that the ORDINARY HALF-YEARLY GENERAL MEETING of the Proprietors of this Company will be held at this Office on Wednesday, the 27th inst., at Half-past Twelve o'clock precisely, to transact the usual Business, to declare a Dividend for the Half Year ended the 30th of June last, and to elect Two Directors and One Auditor in place of those who go out by rotation, but who are eligible to be re-elected.

Notice is Hereby also Given, that the TRANSFER BOOKS of the Company WILL BE CLOSED on the 16th inst., and RE-OPENED on the 28th inst.

By order of the Court of Directors,
H. B. CHAMBERLAIN,
Secretary.

Chief Office: No. 11, George Yard, Lombard Street, London, E.C.,
Sept. 6, 1899.

SALES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MR. ALFRED RICHARDS begs to notify that his AUCTIONS of STOCKS and SHARES in London, Suburban, and Provincial Gas and Water Companies are held MONTHLY, at the Mart, Tokenhouse Yard, E.C.

He also undertakes the issuing by Auction of Gas and Water Stocks and Shares under Parliamentary Powers.

Terms for issuing such Capital, and also for including Gas and Water Stocks and Shares in these periodical Sales, can be obtained on application at Mr. Alfred Richards's Offices, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
PLYMOUTH AND STONEHOUSE GASLIGHT AND COKE COMPANY.

NEW ISSUE OF CAPITAL.

MR. ALFRED RICHARDS will Sell BY AUCTION, at the Mart, Tokenhouse Yard, EC., on
TUESDAY, the 10th of OCTOBER, 1899,
at Two o'clock precisely, in Lots,
£5000 OF ORDINARY STOCK
OF THE
PLYMOUTH AND STONEHOUSE GASLIGHT AND COKE COMPANY,
ranking for a Standard Dividend of 5 per cent., subject to the Sliding-Scale; the last Dividend having been 6¼ per cent.

Particulars of the SECRETARY of the Company, at the Offices, PLYMOUTH; and of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

TOTTENHAM AND EDMONTON GASLIGHT AND COKE COMPANY.

MR. ALFRED RICHARDS will include in the above Sale
£950 "A" STOCK, and
£600 "B" STOCK
in the above Undertaking, and upon which the last Dividends paid were 6 and 4½ per cent. respectively.
Particulars of the AUCTIONEER as above.

Re Mrs. Louisa Baynes, deceased.

REIGATE GAS COMPANY, SUTTON GAS COMPANY, AND NEWHAVEN GAS COMPANY.

MR. ALFRED RICHARDS will include in the above Sale
REIGATE GAS COMPANY—£290 STOCK.
SUTTON GAS COMPANY—80 £10 SHARES and £100 FOUR PER CENT. DEBENTURE.
NEWHAVEN GAS COMPANY—134 £10 fully-paid SHARES.
Particulars of the AUCTIONEER as above.

NOTICE.

COIN-FREED GAS-METERS.

METERS LIMITED, Registered Owners of the Letters Patent 2662 of 1898 granted to Joseph Nasmith and Arthur Mercer for an Invention for "IMPROVEMENTS IN AND RELATING TO COIN-FREED GAS-METERS," which Invention is in respect of a detachable Prepayment Attachment, HEREBY WARN MAKERS, SELLERS, and USERS from making or using any detachable Prepayment Attachment in Infringement of their Legal Rights.

Proceedings will be instituted against any or all persons so infringing.

Dated this 30th day of August, 1899.

E. ROBINSON WALKER & SON,
Solicitors, 18, St. Ann Street, Manchester.

Price 6s., Cloth Bound,

THE CHEMISTRY OF ILLUMINATING GAS.

By N. H. HUMPHRYS, Assoc.M.Inst.C.E., F.C.S.

LONDON: Walter King, 11, Bolt Court, Fleet St., E.C.

NITRATE of Thorium and Cerium. FABRIK CHEMISCHER PRAEPARATE VON STHAMER, NOACK, AND CO., HAMBURG.

ENRICH YOUR GAS
WITH CHEAP
BENZOL
SPECIALLY PREPARED, FREE FROM SULPHUR.

AT to-day's Price of Benzol, Illuminating POWER costs less than ONE-THIRD OF A PENNY PER CANDLE.

Apply to SADLER & CO., MIDDLESBROUGH.

DISPENSE WITH CANNEL COAL
and
INCREASE YOUR ILLUMINATING POWER
by using the
WHESSOE-MUNICH BENZOL CARBURETTER
The Cheapest and Best in the Market.

The Managers of Tynemouth, Middlesbrough, and Darlington Gas-Works are much pleased with it, and would not be without it.

Apply to the Sole Makers:
THE WHESSOE FOUNDRY COMPANY, LIMITED, DARLINGTON.

COKE-BREAKERS,
PRICES REDUCED.
(THOMAS & SOMERVILLE'S PATENT)
With Elevators and Conveyors worked by Steam or Gas Engine.

GEORGE WALLER & CO.,
165, QUEEN VICTORIA STREET, E.C.;
And at STROUD, GLOUCESTERSHIRE.

BOLDON GAS COALS.

ANALYSIS.

Yield of Gas per Ton. .	10,500	Cubic Feet.
Illuminating Power . .	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

For Prices, &c., apply to
W. H. PARKINSON,
THE HARTON COAL CO., LTD.,
NEWCASTLE-ON-TYNE.

Telegraphic Address: "PARKINSON, NEWCASTLE."

LONDONDERRY GAS COALS
FROM THE
MARQUIS OF LONDONDERRY'S COLLIERIES,
COUNTY OF DURHAM.

Available Output up to 5000 Tons per day.
Yield of Gas 11,000 cubic feet per Ton of Coal as per Analysis by
Mr. John Pattinson, F.C.S., F.I.S.

FOR PRICES AND PARTICULARS, APPLY TO
S. J. DITCHFIELD,
SEAHAM HARBOUR, COUNTY OF DURHAM.

PRICE'S COKE & COAL BARROW

effects a great saving of time, labour, and expense.

For Particulars, Price, &c., apply to Mr. EDWARD PRICE, 119, Queen's Road, FINSBURY PARK, N.

Prices are Reduced.

JAMES OAKES & CO.
ALFRETON IRON-WORKS, DERBYSHIRE,
AND
Wenlock Iron Wharf, 21 & 22, Wharf Road, CITY ROAD, LONDON, N.,

Manufacture and keep in Stock at their Works (also large stock in London)

PIPES and CONNECTIONS, 1½ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with Bolts, Nuts and Covers, and rendering Leakage impossible.

THORNLEY GAS COALS
WORKED BY THE
WEARDALE IRON & COAL Co., Ld.
OUT OF THEIR
THORNLEY AND WHEATLEY HILL COLLIERIES.

Analysis made by
Messrs. J. & H. S. PATTINSON.

Yield of Gas per Ton . .	10,500 Cub. Ft.
Illuminating Power . . .	16·9 Candles.
Coke (of good quality) .	67·5 per Cent.
Sulphur	0·58 ,,
Ash	2·73 ,,

For Price, &c., apply to the
WEARDALE IRON & COAL Co., Ld.
QUAYSIDE, NEWCASTLE-ON-TYNE.

THOMAS TURTON AND SONS, LIMITED,
SHEAF WORKS, SHEFFIELD,
MANUFACTURERS OF
FILES OF BEST QUALITY
FOR ENGINEERS.
STEEL OF ALL DESCRIPTIONS.
SCREW STOCKS, TAPS AND DIES,
SPANNERS, RATCHET BRACES, LIFTING JACKS,
ANVILS, VICES,
AND ENGINEERS' TOOLS GENERALLY.
LONDON OFFICE:
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WELDON MUD
FOR
GAS PURIFICATION.
For use in the
RECOVERY OF SULPHUR,
ALSO
Removal of last Traces of SULPHURETTED HYDROGEN in catch position.

Full Particulars on application to the Patentees:
GAS DESULPHURIZATION CO.,
— LIMITED. —
1, FENCHURCH AVENUE, LONDON, E.C.

THOMAS DUXBURY & CO.,
16, DEANSGATE, MANCHESTER.
GAS ENGINEERS' AGENTS AND CONTRACTORS FOR
Meters, Fire-Clay Goods, Oxide of Iron, and all other Gas Apparatus. Retort Carbon purchased.
Inquiries Solicited.
Telegrams: "DARWINIAN, MANCHESTER."
Telephone 1806.

HOLMSIDE
GAS COALS.
Present Daily Produce over 5000 Tons.
Latest Analysis—By CHARLES PHILLIPS, Gas Examiner to Rotherham Corporation

Yield of Gas per Ton . . . 11,205 Cubic Feet.
Illuminating Power 16$\frac{7}{10}$ Stand. Sperm. Candl.
Coke (of good & pure quality) 13$\frac{3}{4}$ Cwt. per Ton.
Sulphur . . . . . A little over 1 per Cent.
Ash . . . . . Under 1 per Cent.
Tar . . . . . 163 lbs. (Avoir.) per Ton.
Ammoniacal Liquor 103 lbs. (Avoir.) per Ton.

HOLMSIDE GAS COALS are supplied to the largest Gas Companies in England and on the European Continent; London alone consuming about half the produce.

SOUTH MOOR
PELTON GAS COALS.
Present Daily Produce available 3000 Tons.

Of equal quality to the "Holmside" Coal, and also very largely used by many Gas Companies at Home and Abroad.

Both descriptions are shipped at Tyne Docks, and Dunston Staiths, River Tyne, also at North and South Docks, Sunderland.

These Coals may be bought through the Principal Merchants in England, or direct from

MR. MARK ARCHER,
HOLMSIDE & SOUTH MOOR OFFICES,
NEWCASTLE-UPON-TYNE.

THE
"FARRINGDON" LANTERN
FITTED WITH STEEL ENAMELLED WHITE REFLECTOR.

This Favourite Lamp has been largely adopted by many Corporations and Lighting Authorities.

Fitted with the Patent Talbot Bye-Pass Tap and Clay's Anti-Vibratory Coil and No. 4 New Welsbach Burner.

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Telephone: 1215 HOLBORN.
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Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887, for
CANNEL & COAL.

TYNE
BOGHEAD
CANNEL.

Yield of Gas per ton . . . . . 13,155 cub. ft.
Illuminating Power . . . . . 38·22 candles.
Coke per ton . . . . . 1,301·88 lbs.

EAST PONTOP
GAS COAL.

Yield of Gas per ton . . . . . 10,500 cub. ft.
Illuminating Power . . . . . 17·8 candles.
Coke . . . . . 70 per cent.

SOUTH PELAW MAIN
GAS COAL.

Yield of Gas per ton . . . . . 10,500 cub. ft.
Illuminating Power . . . . . 16·3 candles.
Coke . . . . . 73·1 per cent.

For Prices and complete Analysis, apply to
THOS. W. DANCE & SONS,
COAL OWNERS, NEWCASTLE-ON-TYNE;
OR
E. FOSTER & CO.,
21, JOHN STREET, ADELPHI, LONDON, W.C.

NEW
INCANDESCENT MANTLES
"CEROFIRM"
CONSTANT LIGHT
REGENERATING CERIUM.

TESTIMONIALS.

PHYSIK. TECHN. REICHSANSTALT, Charlottenburg.

"CEROFIRM"	0·2 hours	84	H.K.	30 mm.
	100 ,,	79	,,	112 litres.
	200 ,,	81	,,	

Professor Dr. BUNTE, Karlsruhe, testifies "**Cerofirm,**" **after 200 hours, same light as Auer (Welsbach) after 24 hours.**

Dr. HUGO KRUSS, Hamburg, states—

"CEROFIRM"	0·5 hours	79	H.K.	33-35 mm.
	800 ,,	79·5	,,	115 litres.
	1600 ,,	74	,,	

STADT BELEUCHTUNGS INSPECTION, München, publishes in the "Journal für Gasbeleuchtung," No. 36, 2/9/99—"**Cerofirm**" **after 2412 hours, 70 H K., 35 mm., 110 litres.**

Many other Testimonials of leading Experts and Gas-Works may be given by Letter.

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Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.
Proprietors of
BEST GLASSHOUSE POT & CRUCIBLE CLAY.
Shipments Promptly and Carefully Executed.

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UNEQUALLED.
Gas Companies are solicited to try Samples of the
MIRFIELD
BLACK BED GAS COAL.
Prices and Analysis on application.
MIRFIELD (GAS-COAL) COLLIERY COMPY.
RAVENSTHORPE, near DEWSBURY.

NEWBATTLE CANNEL.
Highest Results in Gas, & Excellent Coke.
QUOTATIONS ON APPLICATION TO
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LIMITED,
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INCLINED RETORTS
UP-TO-DATE FURNACES AND SETTINGS.

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SAWER & PURVES, NELSON METER WORKS, MILES PLATTING, **MANCHESTER,**
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MANUFACTURERS OF
IMPROVED WET GAS-METERS IN CAST-IRON CASES,
THE UNVARYING WATER-LINE GAS-METER,
IMPROVED DRY GAS-METERS.
Speciality: PATENT CASH PREPAYMENT METERS.
CATALOGUE SENT ON APPLICATION.

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JONAS DRAKE & SON
SOLE AGENTS FOR
HISLOP'S
PATENT REGENERATIVE FURNACES
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RETORT BENCHES ERECTED COMPLETE WITH OR WITHOUT SPECIAL FURNACES.
RESULTS GUARANTEED.
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Designs and Estimates on Application.
GASEOUS FIRING A SPECIALTY.

ESTABLISHED 1844. **ORIGINAL MAKERS.** ESTABLISHED 1844.

LONDON, 1851. NEW YORK, 1853. PARIS, 1855. LONDON, 1862. DUBLIN, 1865. PARIS, 1867.

THE SIX MEDALS AWARDED TO THOMAS GLOVER'S PATENT DRY GAS-METERS;
The latter being the Highest Award for Dry Gas-Meters at the Paris Exhibition, 1867. Since then we have not Exhibited FOR PRIZES.

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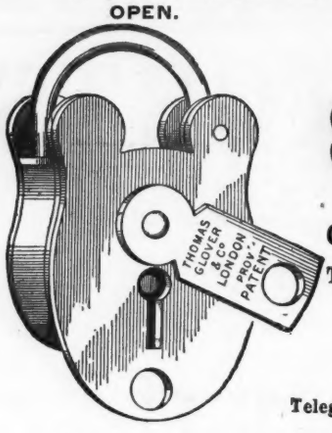

THOMAS GLOVER & CO.'S

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SECURE PADLOCK

PREVENTS TAMPERING WITH THE

CASH-BOXES OF PREPAYMENT METERS.

The Padlock is Sealed by means of a Lead Eyelet, which is impressed with Company's private mark. Eyelets easily fixed and removed by Company's Collector.

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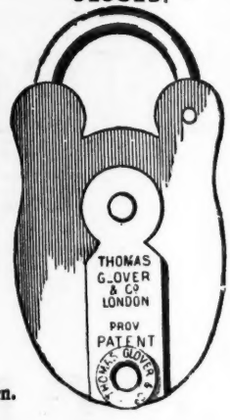

Telegraphic Address: "GOTHIC, LONDON." Telephone No. 725, Holborn.

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DRY GAS-METER MANUFACTURERS,

214 TO 222, ST. JOHN STREET, CLERKENWELL GREEN, LONDON, E.C.

BRISTOL:	BIRMINGHAM:	MANCHESTER:	GLASGOW:
28, BATH STREET.	1, OOZELLS STREET.	37, BLACKFRIARS STREET.	ARGYLE WORKS, KINNING PARK.
Telegraphic Address: "GOTHIC."	*Telegraphic Address: "GOTHIC."*	*Telegraphic Address: "GOTHIC."*	*Telegraphic Address: "GASMAIN."*
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OIL FOR GAS MAKING

PURE DISTILLATE.

HOMOGENEOUS IN CHARACTER.

NO MIXTURE.

CAN BE STORED SAFELY ANYWHERE.

FLASH POINT GUARANTEED OVER 200° FAHR.

(ABEL'S CLOSED TEST.)

ANGLO-CAUCASIAN OIL COMPANY, LTD.

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We Undertake Contracts for Complete
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with all the Latest Improvements,
as Erected by us at

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THE MOST SATISFACTORY INSTALLATION
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INSTALLATIONS ERECTED FREE FROM ROYALTIES.

R. DEMPSTER & SONS,
LIMITED,

ELLAND, YORKS.

Telegraphic Address:
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Telephone:
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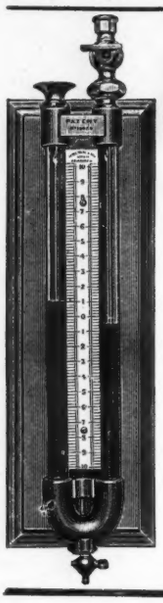
STOURBRIDGE.

MANUFACTURERS OF
BEST FIRE-BRICKS; INCLINED, HORIZONTAL, and SECTIONAL RETORTS; LUMPS, TILES, &c., of every description.
Established 1860.

THE THAMES BANK IRON CO.
UPPER GROUND STREET, LONDON, S.E.,
SUPPLY FROM STOCK
CAST-IRON RETORTS
AND ALL KINDS OF GAS-WORKS APPARATUS.
SOCKET-PIPES FOR GAS OR WATER PURPOSES.
FLANGE PIPES FOR STEAM.
Sole Manufacturers of **LYON'S "PATENT" GAS-MAIN SYPHONS.**
AGENTS FOR
ATTERTON'S PATENT APPARATUS for CHARGING RETORTS.



James Milne & Son
LIMITED
GAS ENGINEERS
MILTON HOUSE WORKS
EDINBURGH.
LONDON.
LEEDS. GLASGOW.

HARPER & MOORES,
STOURBRIDGE.

MANUFACTURERS OF
BEST FIRE-BRICKS, GAS-RETORTS,
LUMPS, TILES, AND ALL ARTICLES IN FIRE-CLAY.
Proprietors of Best Glasshouse Pot, Crucible, and other Stourbridge Clays.
Manufacturers of Glasshouse Pots and Crucibles of every kind.
Established 1836.

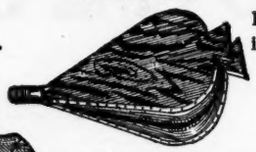
WILLIAM INGHAM & SONS,
Incorporated with the Leeds Fire-Clay Company, Ltd.,

WORTLEY FIRE-CLAY WORKS.
Near LEEDS,
Have confidence in drawing the special attention of GAS ENGINEERS to the following advantages of their Retorts:—
1. **Smooth interior, preventing adhesion of Carbon.**
2. **They can be made in one piece up to 10 feet long.**
3. **Uniformity in thickness, ensuring equal Expansion and Contraction.**

PATENT
MACHINE-MADE GAS-RETORTS.

THOMAS BUGDEN,
Manufacturer of

Bellows for Inflating Gas-Bags. Made in various sizes.



Bellows made to inflate a 48-inch Bag under One Minute.

Miners' Woollen Jackets.

India-rubber Hose, Sheet, and Washers of every description, Leather Bands, Oils, &c., Diving and Wading Dresses, Waterproof Coats, Capes, and Sewer Boots.
Stokers' Mitts, from 14s. doz.
Special Air Tubing made for Gas Companies.

Gas-Bags for Mains.

71, GOSWELL ROAD, E.C., AND AT
256, PENTONVILLE ROAD, KING'S CROSS, N.

HARRIS & PEARSON,
STOURBRIDGE, ENGLAND.
MANUFACTURERS OF
FIRE-CLAY GAS-RETORTS, FIRE-BRICKS, LUMPS, & TILES of Every Description.
GLAZED BRICKS AND PORCELAIN BATHS.

MOBBERLEY & PERRY
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Manufacture & supply best quality of
Gas Retorts (SEGMENTAL, HORIZONTAL, or INCLINED.)
Special Bricks & Blocks for GENERATOR & REGENERATOR FURNACES.
FIRE BRICKS, LUMPS, & TILES, BLUE STAFFORDSHIRE VITRIFIED BRICKS FOR PAVING, &c. &c.
EVERY REQUISITE FOR GAS-WORKS. Retort Setters sent to any part of the Kingdom.
London Agents: Contractors for the erection of Retort-Benches complete.
Gas Engineers and Contractors,
BALE & HARDY, BRIDGE HOUSE, 181, QUEEN VICTORIA STREET, E.C.

THE SUNLIGHT INCANDESCENT GAS-BURNER

Applications for **AGENCIES** now being received.

NOTE THESE FEATURES:

A1. WHITE MANTLES.
Longest Lived and Highest Candle Power.

'SUNLIGHT' TINTED MANTLES.
Strongest and Pleasantest Colour.

These are **INTERCHANGEABLE** on same Burner.

BURNERS WITH CHIMNEYS.
Cheapest in the Market.

CHIMNEYLESS BURNERS.
Cheapest, Simplest, and Most Efficient.

SELF-LIGHTER.
Only Efficient System.

A great sensation with this unique combination of features is promised to our Agents for the coming season. Any firm of standing, applying early enough, will be very favourably dealt with.

An early visit to the London Show-Rooms is especially solicited.

SPECIAL NOTICE.

Sunlight Tinted Mantles have been declared by the Courts to be "as far asunder as the Poles" from the Welsbach System, and we guarantee that our

SUNLIGHT WHITE MANTLES

are NO Infringement of that or any other Patent, and are made under a Series of Independent Patents, and by an entirely New Process.

We give with every Mantle sold an absolute indemnity to both seller and user against all molestation on this account.

Price Lists, &c., on application.

New Sunlight Incandescent Co., Ltd.,

33 & 34, SHOE LANE, LONDON, E.C.

Telegrams: "IGNIFLUOUS." A.B.C. and A1. Codes used. Telephone: No. 947 Holborn.

WILSON CARTER & PEARSON,

GAS COAL AND CANNEL FACTORS,

Supply to any Railway Station, or for Export, all kinds of Fuel for Gas purposes.

ADDRESS CHIEF OFFICES:

Temple Buildings, 50, New Street, Birmingham.

ARROL-FOULIS

Patent Automatic Machinery

FOR

DRAWING AND CHARGING GAS-RETORTS.

Full Particulars may be obtained from the Sole Makers,

SIR WILLIAM ARROL & CO., Limited,

GLASGOW.

[See Illustrated Advertisement, Sept. 5, p. 579.]

PETTIGREW'S PATENT

Sulphate of Ammonia Plant

ON THE CONTINUOUS SYSTEM

Is the newest in the Market, and is the outcome of practical experience in Sulphate Making.

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LIGHT SYNDICATE,

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still hold their own on the market for the

HIGHEST CANDLE POWER

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550-CANDLE POWER,

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and Bandsept, who was the first to adopt the Injector Principle, is

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ON THE MARKET.

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IMPROVED GAS-METER PERSIANS.

UNSURPASSED FOR QUALITY AND VALUE.

MAKERS OF
CLAYTON, SON & Co LTD LEEDS.
ALL KINDS GAS PLANT
12,100,000 CUB FT CAPACITY.
COMPLETED IN 12 MONTHS
GASHOLDERS
SPECIALITY
IT IS 300 FT DIAR. HAS SIX LIFTS, EACH 30 FT DEEP. HAS NO ROPES OR SPIRAL GUIDES.
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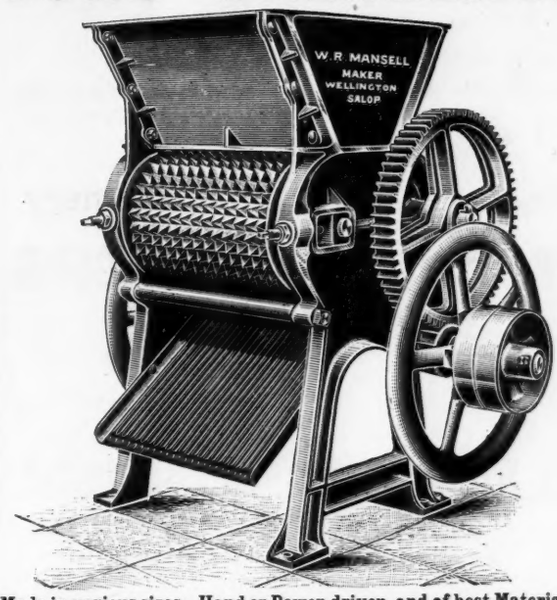
Established 1823.

COKE-BREAKERS.



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IMPROVED

Water-Cooled Condensers

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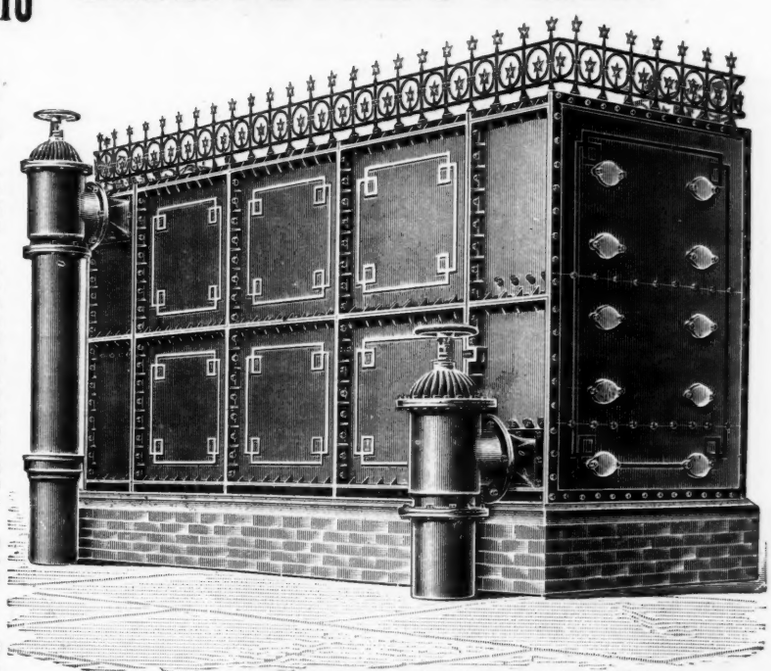
This water-cooled Gas Condenser is designed to work against the great variations of temperature between day and night, sunshine and shade, summer and winter, which are found in this and other countries.

Water being the cooling medium, the temperature of the gas can be kept under control better than with air; and the gas can be sent forward to the purifying plant at the proper temperature for efficient and economical purification.

The cold water enters at the bottom, and gradually rises to the top as the water absorbs heat, thus causing the warm gas to meet the warm water first, and to leave the Condenser in contact with water at any desired temperature by simply regulating the feed-water tap. The gas is thus **cooled progressively, uniformly, and effectually.** The simple construction of this Condenser affords a large cubical capacity, so that the gas remains in a considerable time, and secures all the advantage due to slow-speed condensation. Every part of the Condenser is easily accessible, and by removing the end plates the whole of the interior can be got at. It can be erected under cover, and protected from extremes of heat or cold.

R. & J. DEMPSTER, LTD., recommend this Condenser to be used as a Finishing Condenser, after the gas has already passed through the ordinary Annular or Air Condensers.

Condensers of this type equal to 10,500,000 cubic feet per 24 hours already erected and at work.



From a Photograph of Condenser erected at the Gas-Works, Widnes. Capacity 1,500,000 cubic feet per 24 hours.

W. PARKINSON & CO.

SQUARE STATION METERS.

PARKINSON'S PATENT EQUILIBRIUM GOVERNORS.

A very large number are now at work; and all Engineers who have adopted them speak in unqualified terms of their great efficiency.

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as desired.
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[See also Advt. p. 688.

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